EVALUATION OF NEW DEPRESSANTS FOR THE SELECTIVE FLOTATION OF MASSIVE SULPHIDE ORES (UP-L188)

FINAL REPORT

BY

LAKEFIELD RESEARCH OF CANADA LIMITED

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ABSTRACT

This report contains the results of bench-scale flotation tests carried out on samples of copper-zinc, lead-zinc and copper-lead-zinc ores from operating mines (i.e. Noranda-Geco, Kidd Creek Mines Limited, Cyprus Anvil Mines Limited and Brunswick Mining and Smelting Corporation Limited), to compare the effectiveness of newly-developed organic depressant mixtures with the standard inorganic depressants currently in use for treatment of these ores.

These organic depressant mixtures were prepared from high-molecular weight lignin-sulphonate (H) and guar or starch at an elevated temperature (40°C) in the presence of $ZnSO_4$, SO_2 or other inorganic reagents. The depressant mixtures are referred to as LS depressants.

The results from this study showed the following:

1. The use of the organic LS depressants for selective flotation of copper-zinc ores from Geco and Kidd Creek Mines was beneficial in the following ways:
    a) Improved metallurgical results from both Geco and Kidd Creek ores (Table No. 1)
    b) Improved selectivity between copper and pyrite minerals
    c) On Geco ore, the cyanide was omitted with no deterioration in metallurgical results and collector requirements were lower. On Kidd Creek ore, consumption of lime and SO_2 was substantially reduced.

Abstract - Cont'd

Table No. 1

Effect of LS Depressants on Cu-Zn Ores - Comparison of Results

Ore	LS3 or NaCN	Product	Weight %	Assays, %		% Distribution	
				Cu	Zn	Cu	Zn
Geco (Noranda)	LS3	Cu Concentrate	5.69	27.6	2.58	88.2	4.0
		Zn Concentrate	5.29	0.6	55.30	1.8	80.7
	NaCN	Cu Concentrate	5.56	27.9	3.56	85.7	5.4
		Zn Concentrate	5.33	1.48	55.40	5.2	81.2
Kidd Creek (Texas Gulf)	LS3	Cu Concentrate	8.64	28.5	4.21	92.2	8.8
		Zn Concentrate	6.00	0.76	54.5	1.7	79.1
	SO_2 Lime	Cu Concentrate	9.98	25.0	5.16	90.9	11.5
		Zn Concentrate	6.70	0.74	51.40	1.8	77.2

2. The use of LS depressants for treatment of the Pb-Zn ore of Cyprus Anvil resulted in the following:

a) Improved lead-pyrite selectivity. The final lead concentrate grade was higher, with no losses in lead recovery (Table No. 2)

b) The consumption of cyanide was reduced by 50 %. The omission of cyanide, however, was not possible, since lead did not float without some cyanide

Table No. 2

Effect of LS Depressants on Pb-Zn Ore - Comparison of Results

Ore	LS3	Product	Weight %	Assays, %		% Distribution	
				Pb	Zn	Pb	Zn
Faro (Cyprus Anvil)	70 g/t	Pb Concentrate	7.11	59.5	4.88	83.0	6.0
		Zn Concentrate	10.38	0.44	50.38	0.9	77.5
	Nil	Pb Concentrate	7.66	55.40	5.07	83.5	5.8
		Zn Concentrate	10.51	0.49	49.90	1.0	77.6

Abstract - Cont'd

3. On the Cu-Pb-Zn-Ag from Kidd Creek Mines, the additions of LS depressant improved selectivity between Cu-Pb and Zn minerals as shown in Table No. 3. In addition, the consumption of SO_2 and lime was reduced.

Table No. 3

Effect of LS Depressants on Cu-Pb-Zn-Ag Ore - Comparison of Results

Ore	LS	Product	Weight %	Assays, %			% Distribution		
				Cu	Pb	Zn	Cu	Pb	Zn
Kidd Creek (Texas Gulf)	250 g/t	Cu-Pb Cl. Conc.	6.56	7.92	10.8	8.41	86.1	60.7	7.8
		Cu-Pb Ro. Conc.	16.64	3.33	5.36	12.31	91.9	76.5	29.0
	Nil	Cu-Pb Cl. Conc.	10.03	5.61	8.48	8.92	90.6	65.1	12.5
		Cu-Pb Ro. Conc.	23.03	2.54	4.24	10.83	94.1	74.4	34.9

4. On Cu-Pb-Zn ore from New Brunswick Mine, the effectiveness of LS depressants could not be established. With additions of LS depressants, some improvement was noted but the results were not confirmed.

INTRODUCTION

This final report contains the details of testwork carried out under auspices of the Canada Centre for Mineral and Energy Technology, Energy, Mines and Resources Canada (Contract No. 23SQ.24440-2-9130), to evaluate new depressants for the selective flotation of massive sulphide ores.

The objective of this study was to compare the effectiveness of newly-developed organic depressant mixtures for the selective flotation of base metal sulphides with standard inorganic depressants such as cyanide, zinc sulphate, lime and sulphurous acid.

During the course of the testwork monthly progress reports were issued.

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SUMMARY AND CONCLUSIONS

1. Organic LS Depressant Mixtures

Organic depressants such as high-molecular weight lignin sulphonates and various guars and starches, are used as depressing aids during the processing of massive sulphide ores. However, they are not selective depressants and can depress valuable minerals (Cu, Pb). During the testing of various ores, it was found that mixing lignin-sulphonate (H) with starch or guar in the presence of inorganic compounds such as $ZnSO_4$ and H_2SO_3, would result in powerful depressants for pyrite and gangue that would not interfere with either chalcopyrite or galena flotation.

In this study, various organic mixtures (LS depressants) were tested as pyrite, gangue and zinc depressants. These depressants were prepared by pre-mixing the lignin sulphonate H and selected starches or dextrins at elevated temperature, in the presence of inorganic compounds (SO_2, $ZnSO_4$).

2. Description of Ore Samples Used for Evaluation of LS Depressants

2.1. Ore Sources

This research program was conducted on the following ore types:

a) Copper-zinc ore
b) Lead-zinc ore
c) Copper-lead-zinc ore

The ore sources and locations are given in Table No. 4.

Summary and Conclusions - Continued

2.1. Ore Sources - Cont'd

Table No. 4

Ore Sources and Description

Composite No.	Ore Type	Mill	Location
1	Copper-Zinc	Noranda (Geco Division)	N. Ontario (Manit.)
2	Copper-Zinc	Kidd Creek A	N. Ontario (Timmins)
3	Copper-Lead-Zinc	Kidd Creek B	N. Ontario (Timmins)
4	Copper-Lead-Zinc	Brunswick Mining and Smelting	New Brunswick
5	Lead-Zinc	Cyprus Anvil Mining Co.	Y.T. (Faro)

2.2. Ore Characteristics and Head Analyses

The head analyses of the ores used in this study are shown in Table No. 5.

Table No. 5

Head Analyses of the Ore Samples

Composite	Assays, %, g/t						
No.	Cu	Pb	Zn	Fe	S	Au	Ag
1	1.78	0.10	3.54	14.7	14.0	0.12	38.3
2	2.66	0.16	4.42	13.4	10.6	0.05	47.9
3	0.58	1.22	7.05	20.8	21.5	0.05	259.0
4	0.31	3.32	8.55	27.4	32.0	0.65	99.6
5	0.13	5.25	6.64	31.4	38.4	0.09	52.6

Most of the ores used for the evaluation were complex massive sulphides, consisting of pyrite, pyrrhotite and quartz as the major gangue minerals. With the exception of Composite 1 (Geco ore), these ores are relatively fine grained and require fine grinding to achieve liberation. All ore samples represent average ore that is currently treated in an operating concentrator.

Summary and Conclusions - Continued

3. Effect of Organic LS Mixtures on the Flotation of Copper-Zinc Ores

3.1. Copper-Zinc Ore From Noranda-Geco Division

A detailed examination of various organic depressants was conducted on this ore. These depressants were compared with conventional depressants (NaCN, SO_2) currently used in the operating concentrator. The results obtained on this ore indicated the following:

1. With the use of LS3 depressant mixture, the cyanide could be eliminated from the circuit with no deterioration in the metallurgical results (Table No. 6).
2. The overall copper recovery obtained with LS3 depressant was higher than that obtained with cyanide (Figure No. 1).
3. The collector requirements with additions of LS3 depressant could be reduced by 25 % to 50 %.

During the course of the testwork it was observed that the initial rates of copper flotation were much higher with LS3 depressant than with cyanide.

Levels of collector and pH in the copper cleaning were found to be important parameters when evaluating LS depressants. Figure No. 2 shows the effect of pH in the cleaning on copper and zinc recoveries in the copper cleaner concentrate. The type of LS mixture had no significant effect on copper and zinc metallurgical results.

Summary and Conclusions - Continued

3.1. Copper-Zinc Ore From Noranda-Geco Division - Cont'd

Table No. 6

Final Full Scale Tests - Effect of Organic Depressant on Cu and Zinc Flotation

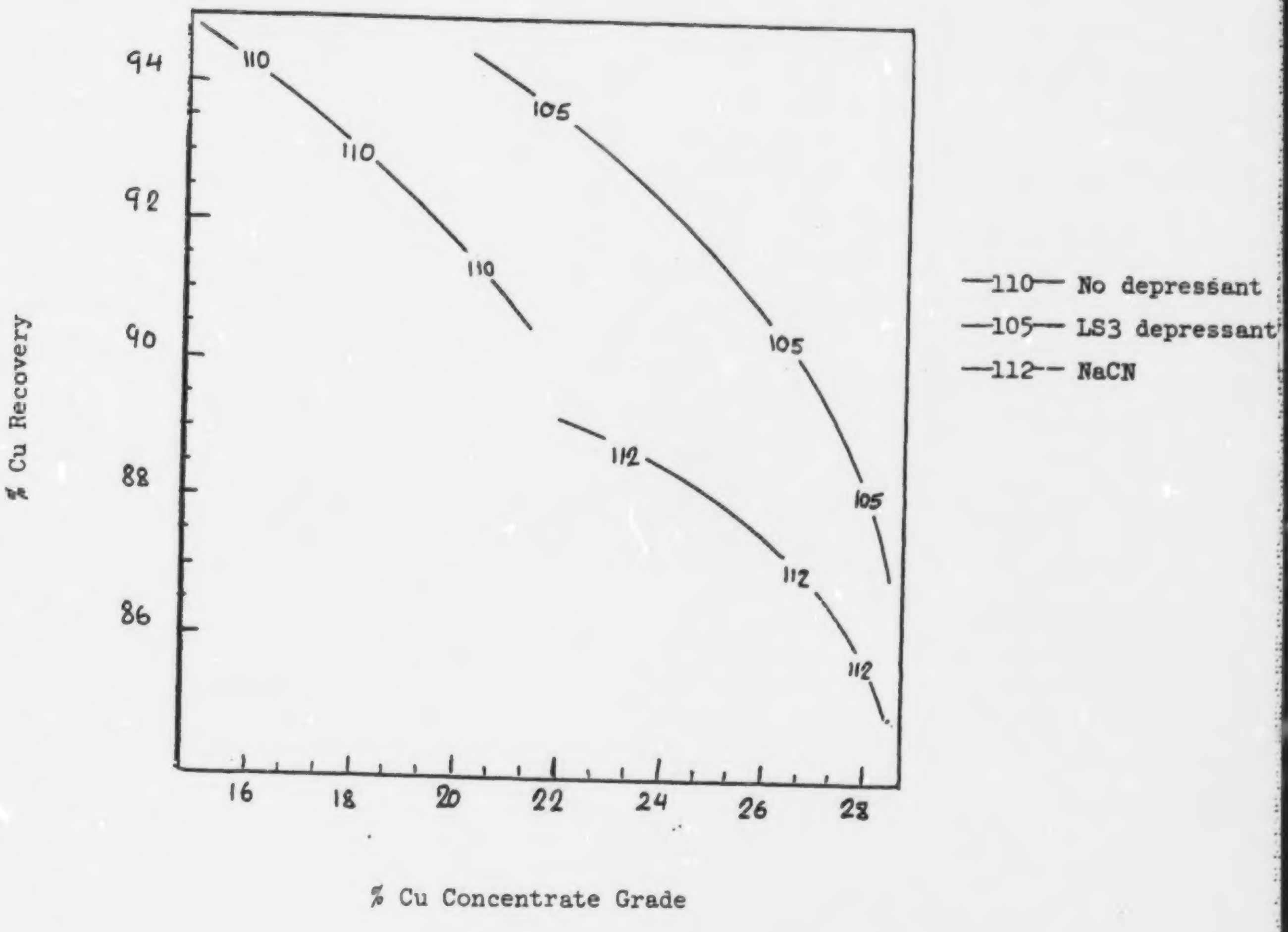
Test	Depressant Added g/t		Product	Weight	Assays, %		% Distribution	
No.	NaCN	LS3		%	Cu	Zn	Cu	Zn
105	0	150	Cu 3rd Cl. Conc.	5.69	27.6	2.58	88.2	4.0
			Cu 1st Cl. Conc.	7.76	21.53	5.63	93.8	12.0
			Zn 3rd Cl. Conc.	5.29	0.60	55.30	1.8	80.7
			Zn Ro. Conc.	13.78	0.52	22.22	4.1	84.5
			Zn Flot. Tail.	78.46	0.047	0.16	2.1	3.5
			Head (Calc.)	100.00	1.78	3.62	100.0	100.0
110	0	0	Cu 3rd Cl. Conc.	8.11	20.2	5.65	91.4	12.7
			Cu 1st Cl. Conc.	10.59	15.95	9.07	94.3	26.6
			Zn 3rd Cl. Conc.	4.56	0.63	54.10	1.6	68.7
			Zn Ro. Conc.	23.15	0.33	11.06	4.2	71.2
			Zn Flot. Tail.	66.26	0.04	0.12	1.5	2.2
			Head (Calc.)	100.00	1.79	3.60	100.0	100.0
112	60	0	Cu 3rd Cl. Conc.	5.56	27.9	3.56	85.7	5.4
			Cu 1st Cl. Conc.	6.95	23.09	7.00	88.7	11.6
			Zn 3rd Cl. Conc.	5.33	1.48	55.4	5.2	81.2
			Zn Ro. Conc.	21.62	0.81	14.39	9.6	85.5
			Zn Flot. Tail.	71.43	0.041	0.14	1.7	88.4
			Head (Calc.)	100.00	1.81	3.63	100.0	100.0

Summary and Conclusions - Continued

3.1. Copper-Zinc Ore From Noranda-Geco Division - Cont'd

Figure No. 1

Cu Concentrate Grade vs. Recovery - Effect of LS3 Depressant on Copper Flotation

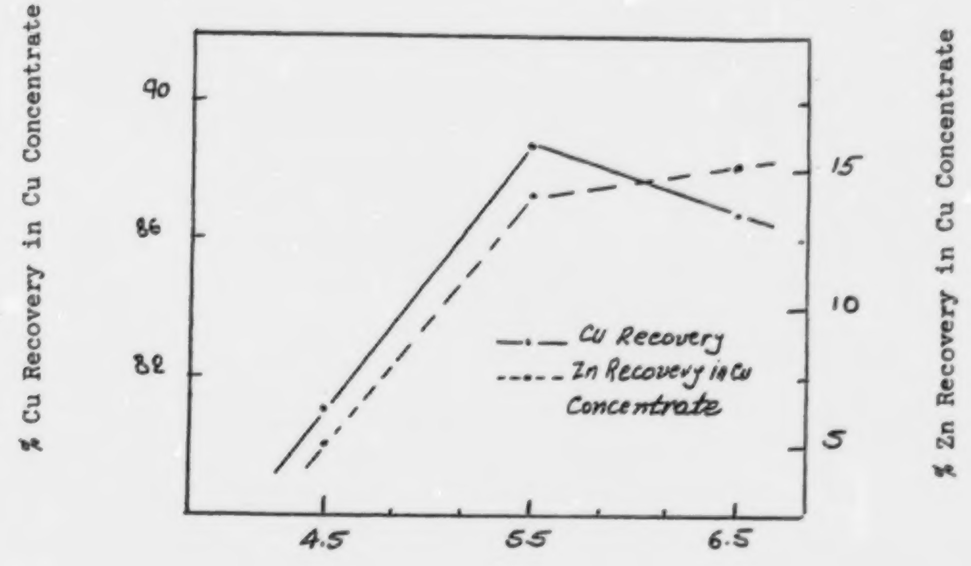


Summary and Conclusions - Continued

3.1. Copper-Zinc Ore From Noranda-Geco Division - Cont'd

Figure No. 2

Cu and Zn Recovery in the Cu Cleaner Concentrate vs. pH



Cu Cleaner pH

Summary and Conclusions - Continued

3.2. Copper-Zinc Ore From Kidd Creek Mines Limited

The net effects of LS depressant on this ore could be described as follows:

1. With additions of LS3 depressant, the copper concentrate grade and recovery were better than those obtained with conventional depressants (Table No. 7, Figure No. 3).

Table No. 7

Effect of Organic Depressant - Comparison of Results

Test	LS3	Product	Weight	Assays, %		% Distribution		
	Added			Cu	Zn	Cu	Zn	
No.	g/t		%				O'all	Circuit
155	150 Ro. + 60 Cl.	Cu 3rd Cl. Conc.	8.64	28.5	4.21	92.2	8.8	-
		Cu 1st Cl. Conc.	10.72	23.63	5.74	94.8	14.9	-
		Zn Cl. Conc.	6.00	0.76	54.50	1.7	79.1	92.9
		Zn Ro. Conc.	13.14	0.67	25.97	3.3	82.5	97.0
		Zn Flot. Tail.	76.14	0.067	0.14	1.9	2.6	3.0
		Head (Calc.)	100.00	2.67	4.13	100.0	100.0	100.0
149	0	Cu 3rd Cl. Conc.	9.98	25.0	5.16	90.9	11.5	-
		Cu 1st Cl. Conc.	12.34	20.74	6.25	93.2	17.2	-
		Zn Cl. Conc.	6.70	0.74	51.40	1.8	77.2	93.2
		Zn Ro. Conc.	11.08	0.85	32.02	3.4	79.5	96.0
		Zn Flot. Tail.	76.58	0.12	0.19	3.4	3.3	4.0
		Head (Calc.)	100.00	2.75	4.46	100.0	100.0	100.0

2. With addition of LS-3 depressant, the consumption of lime and SO_2 could be substanially reduced.

When evaluating the LS depressant on this ore the following parameters were found to be important.

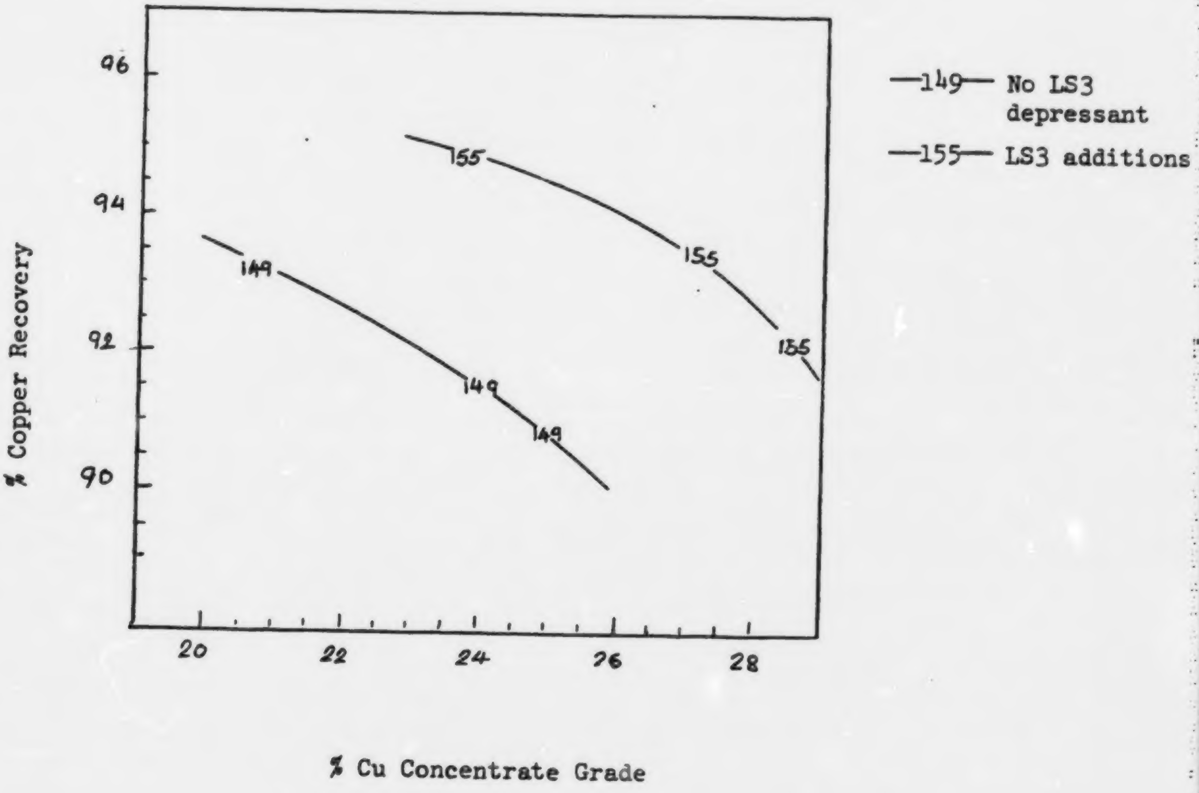
1. Level and point of lime and SO_2 additions. With LS3 depressant, better results were obtained with lower lime and SO_2 additions. Addition of the total lime to the grind instead of to the conditioner, together with a portion of the SO_2, had beneficial effects on copper flotation in the presence of LS3.
2. Type and composition of the LS depressant had no effect on copper metallurgy.

Summary and Conclusions - Continued

3.2. Copper-Zinc Ore From Kidd Creek Mines Limited - Cont'd

Figure No. 3

Cu Grade vs. Recovery - Effect of LS3 Depressant



Summary and Conclusions - Continued

4. Effect of LS Depressants on the Flotation of Lead-Zinc Ores: Cyprus Anvil Mining Corporation

Detailed evaluations of a number of LS depressants under various flotation conditions were conducted on this ore. One of the most interesting features of this ore was that galena did not float without cyanide (Figure No. 4) and therefore the effect of cyanide had to be determined for each flotation stage before evaluating LS depressants.

Complications arose during the testwork with this ore due to the rapid oxidation of the ore even in freezer storage. For this reason, the Na_2CO_3 requirements changed during the course of the testwork.

The effects of LS depressants on this ore could be summarized as follows:

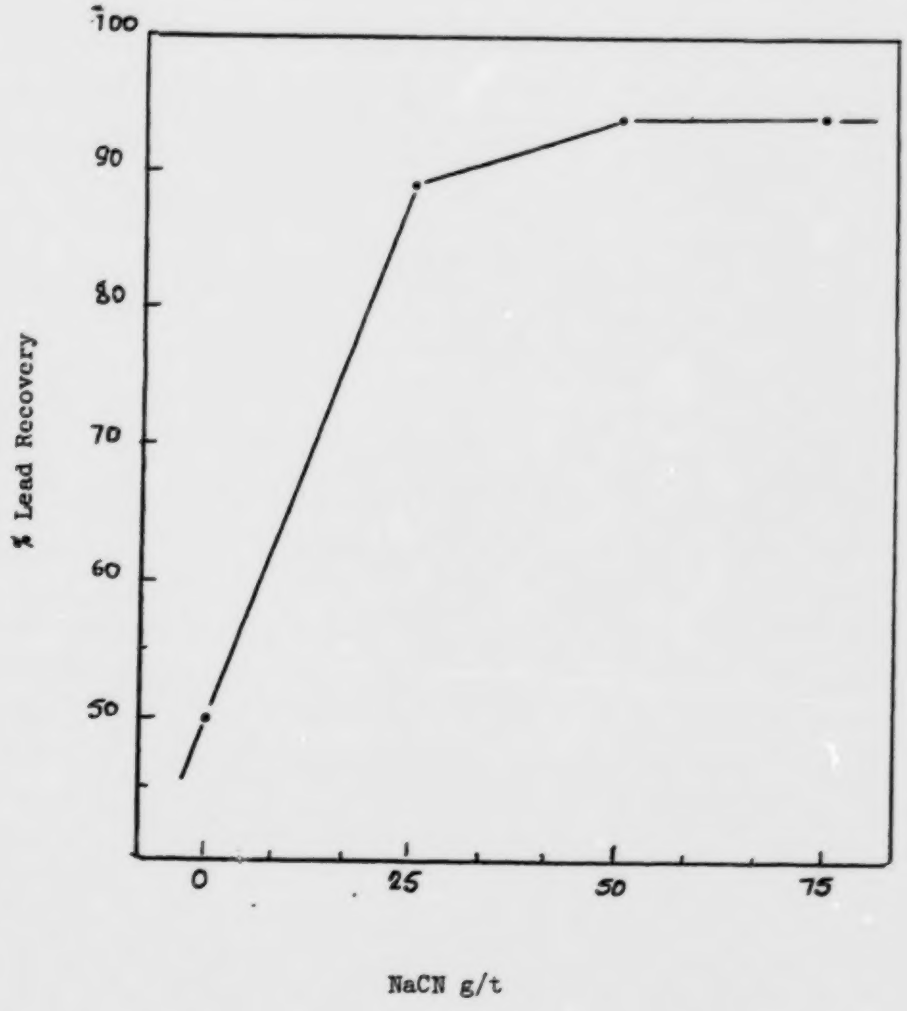
1. Additions of LS3 depressant improved lead-pyrite selectivity and thus a higher concentrate grade was obtained as compared to cyanide additions alone (Table No. 8, Figure No. 5).
2. When using LS3 depressant, the cyanide addition could be reduced by 50 %. Complete replacement of cyanide by organic depressants was not possible, since galena did not float without cyanide.
3. The type of LS depressant had no significant effect on lead flotation and the selectivity between lead and pyrite minerals.

Summary and Conclusions - Continued

4. Effect of LS Depressants on the Flotation of Lead-Zinc Ores: Cyprus Anvil Mining Corporation - Cont'd

Figure No. 4

Lead Recovery in the Lead Rougher Concentrate vs. Level of Cyanide Additions

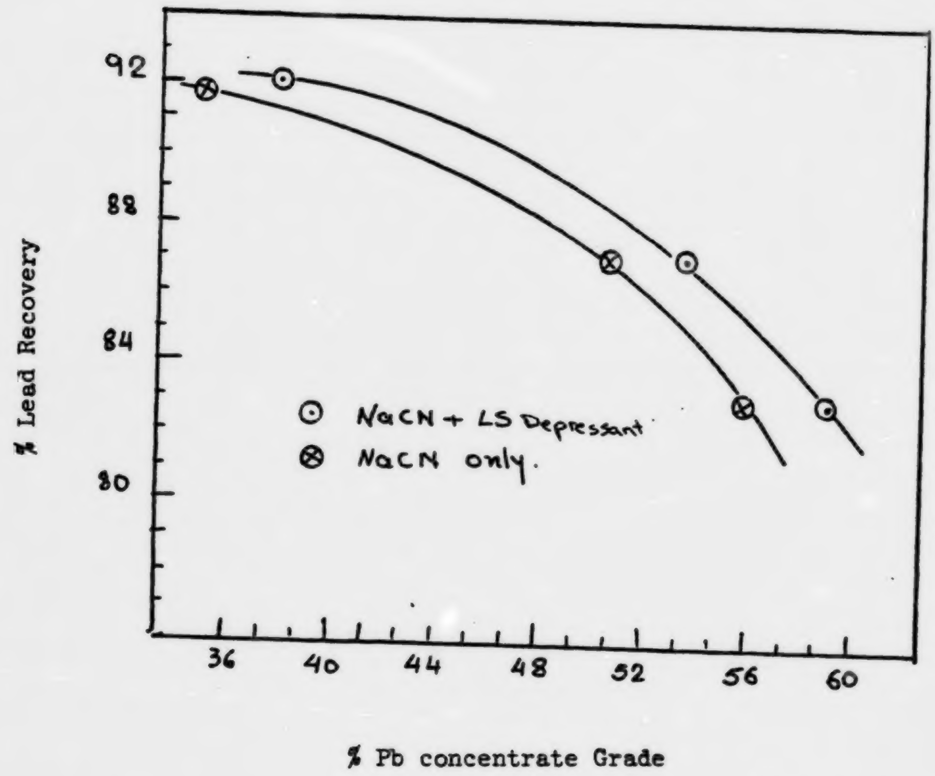


Summary and Conclusions - Continued

4. Effect of LS Depressants on the Flotation of Lead-Zinc Ores: Cyprus Anvil Mining Corporation - Cont'd

Figure No. 5

Lead Grade-Recovery Curves: Effect of LS Depressants



Summary and Conclusions - Continued

4. Effect of LS Depressants on the Flotation of Lead-Zinc Ores: Cyprus Anvil Mining Corporation - Cont'd

Table No. 8

Effect of Organic Depressant - Overall Metallurgical Results

Test No.	Procedure	Product	Weight %	Assays, %		% Distribution	
				Pb	Zn	Pb	Zn
103/ 105	NaCN+LS3B	Pb 4th Cl. Conc.	7.11	59.5	4.88	83.0	6.0
		Pb 1st Cl. Conc.	12.38	38.0	7.00	92.1	12.8
		Zn Cl. Conc.	10.38	0.44	50.38	0.9	77.5
		Zn Ro. Conc.	25.35	0.73	22.55	3.6	84.7
		Zn Flot. Tail.	62.27	0.34	0.38	4.3	2.5
		Head (Calc.)	100.00	5.10	6.74	100.0	100.0
106/ 107	NaCN	Pb 4th Cl. Conc.	7.66	56.40	5.07	83.5	5.8
		Pb 1st Cl. Conc.	13.57	34.99	6.77	91.9	13.6
		Zn Cl. Conc.	10.51	0.49	49.90	1.0	77.6
		Zn Ro. Conc.	19.66	0.81	28.70	3.1	83.6
		Zn Flot. Tail.	66.77	0.39	0.28	5.0	2.8
		Head (Calc.)	100.00	5.16	6.74	100.0	100.0

Summary and Conclusions - Continued

5. Effect of LS Depressants on the Flotation of Copper-Lead-Zinc Ores

5.1. Copper-Leac-Zinc-Silver Ore From Kidd Creek Mines Limited

Only a brief examination of several LS depressants was conducted on this ore. The results obtained showed that in the presence of LS3 depressant, the Cu-Pb and pyrite selectivity improved as compared to the results obtained with conventional depressants. (Table No. 9).

With additions of LS3 depressant, the lime and SO_2 requirements were reduced.

Table No. 9

Effect of LS3 Depressant on Cu-Pb Roughing and Cleaning - Comparison of Results

Test No.	LS-3 Added g/t	Product	Weight %	Assays, %			% Distribution		
				Cu	Pb	Zn	Cu	Pb	Zn
163	230	Cu-Pb Cl. Conc.	6.56	7.92	10.8	8.41	86.1	60.7	7.8
		Cu-Pb Ro. Conc.	16.64	3.33	5.36	12.31	91.9	76.5	29.0
		Cu-Pb Flot. Tail.	83.36	0.058	0.33	6.06	8.1	23.5	71.0
		Head (Calc.)	100.00	0.60	1.17	7.10	100.0	100.0	100.0
164	0	Cu-Pb Cl. Conc.	10.03	5.61	8.48	8.92	90.6	65.1	21.5
		Cu-Pb Ro. Conc.	23.03	2.54	4.24	10.83	94.1	74.4	34.9
		Cu-Pb Flot. Tail.	76.97	0.048	0.43	6.04	5.9	25.3	65.1
		Head (Calc.)	100.00	0.62	1.31	7.14	100.0	100.0	100.0

5.2. Copper-Lead-Zinc Ore From New Brunswick

A detalined evaluation of a number of LS depressants was performed. From the results obtained there was no evidence of the positive effect of LS depressants on Cu-Pb flotation and upgrading.

DISCUSSION

1. Description and Composition of LS Depressants

Table No. 10 shows the composition of the LS depressants used in this testwork.

Table No. 10

Composition of LS Depressants Used in the Testwork With Various Ores

Reagent Description	Composition	Ratio	Preparation		% Solution
			Grams Used	mL Water Used	
LS-1	LS-H,$ZnSO_4$	1:1	1+1	100	2
LS-2	LS-H,$ZnSO_4$,XD21	1:1:1	0.67+0.67+0.67	100	2
LS-3	LS-H,$ZnSO_4$,D1902	1:1:1	0.67+0.67+0.67	100	2
LS-4	LS-H,SO_2	1:1	1+1*	80	2
LS-5	LS-H,SO_2,XD21	1:1:1	0.67+0.67°+0.67	87	2
LS-6	LS-H,SO_2,D1902	1:1:1	0.67+0.67°+0.67	87	2
LS-7	LS-H,Calgon Glass, Cataflot P40	1:1:0.5	1+1+0.5	125	2
LS-8	LS-H,Calgon Glass, $Na_2Cr_2O_7$	1:0.5:0.5	1+0.5+0.5	100	2
LS3A	LS-H,D1902	1:1	1+1	100	2
LS3B	LS-H,$ZnSO_4$	1:1	1+1	100	2
LS3C	LS-H,$ZnSO_4$,D1902	1:0.3:0.7	1+0.3+0.7	100	2

* Added as H_2SO_3 solution 20 mL

° Added as H_2SO_3 solution 13 mL

Discussion - Continued

1. Description and Composition of LS Depressants - Cont'd

The principal constituent of the LS depressants is lignin sulphonate, polymerized by an autoclave treatment to yield a high molecular weight product. This reagent is referred to as LSH (Lignosulphonate H). The second component is either a selected starch or guar manufactured by Hercules Incorporated (XD21) or Stein-Hall (D1902). The third component is usually an inorganic reagent, mainly $ZnSO_4$ or SO_2. The ratios shown with each depressant (Table No. 10) are stricly weight ratios and the additions are based on active content of the compound. The SO_2 is added as H_2SO_3 of known strength. Reagents were prepared every day but we have no knowledge of the rate of degradation if allowed to age for several days. The preparation involved stepwise dissolution of the components in 40°C water under spin bar agitation. The order of dissolution was LS-H first, starch or guar second and inorganic compound last. An addition rate of 150 g/t of LS3 (Ratio 1:1:1) means that the equivalent of 50 g/t LSH, 50 g/t $ZnSO_4$ and 50 g/t D1902 were actually added.

Discussion - Continued

2. Evaluation of LS Depressants on Cu-Zn Ore From Noranda Mines-Geco Division

2.1. Description of Sample Used for Flotation Testwork

The ore used in this testwork was fairly typical Geco ore presently treated in the concentrator with the following head assay:

Copper (Cu) =	1.78 %
Lead (Pb) =	0.10 %
Zinc (Zn) =	3.54 %
Iron (Fe) =	14.70 %
Sulphur (S) =	14.00 %
Gold (Au) =	0.12 g/t
Silver (Ag) =	38.3 g/t

The ore is a massive sulphide ore containing pyrite, pyrrhotite, sphalerite, chalcopyrite, galena, marcasite and quartz. The selectivity between copper and zinc minerals in this ore is not satisfactory and in 1978, a low pH (4.5) copper cleaning circuit was added to the flowsheet to reduce the zinc content of the copper concentrate from 8 % Zn to 4.5 % Zn respectively.

2.2. Laboratory Test Procedure for Testing Cu-Zn Geco Ore

The typical laboratory procedure for testing Geco ore is shown in Figure No. 6. When testing different types of Geco ore, reagents such as collectors and depressants (NaCN, SO_2) need to be adjusted for each ore sample.

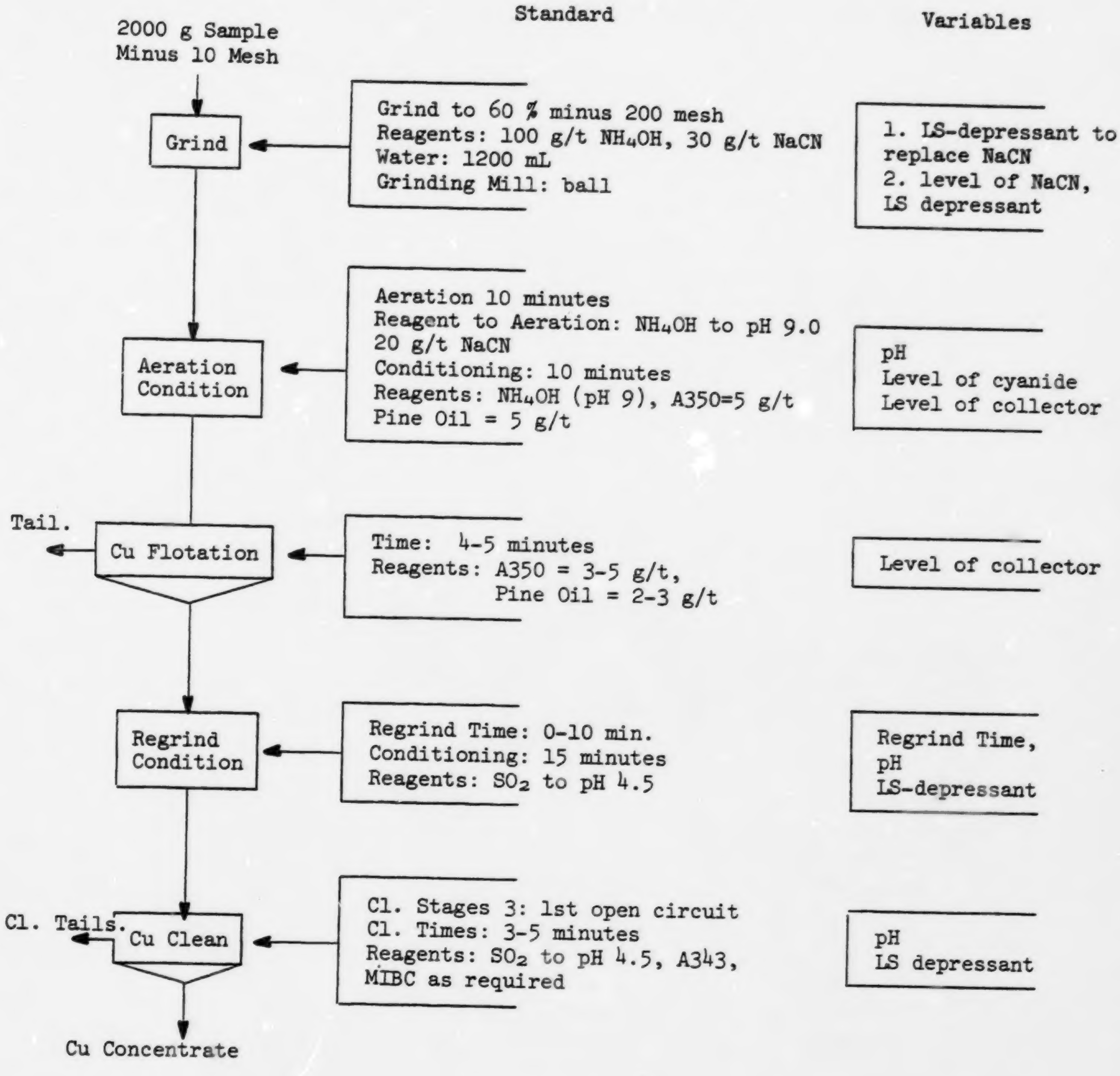
During the evaluation of the LS depressants, the levels of NaCN and SO_2 were varied or replaced by LS depressants. Other adjustments made were levels of collector and pH.

Discussion - Continued

2.2. Laboratory Test Procedure for Testing Cu-Zn Geco Ore - Cont'd

Figure No. 6 - Schematic Outline of Laboratory Procedure for Testing of Cu-Zn Geco Ore

a) Copper


Standard
Variables
2000 g Sample
Minus 10 Mesh
Grind
Grind to 60 % minus 200 mesh
Reagents: 100 g/t NH₄OH, 30 g/t NaCN
Water: 1200 mL
Grinding Mill: ball
1. LS-depressant to replace NaCN
2. level of NaCN, LS depressant
Aeration Condition
Aeration 10 minutes
Reagent to Aeration: NH₄OH to pH 9.0
20 g/t NaCN
Conditioning: 10 minutes
Reagents: NH₄OH (pH 9), A350=5 g/t
Pine Oil = 5 g/t
pH
Level of cyanide
Level of collector
Tail.
Cu Flotation
Time: 4-5 minutes
Reagents: A350 = 3-5 g/t,
Pine Oil = 2-3 g/t
Level of collector
Regrind Condition
Regrind Time: 0-10 min.
Conditioning: 15 minutes
Reagents: SO₂ to pH 4.5
Regrind Time,
pH
LS-depressant
Cl. Tails.
Cu Clean
Cl. Stages 3: 1st open circuit
Cl. Times: 3-5 minutes
Reagents: SO₂ to pH 4.5, A343,
MIBC as required
pH
LS depressant
Cu Concentrate

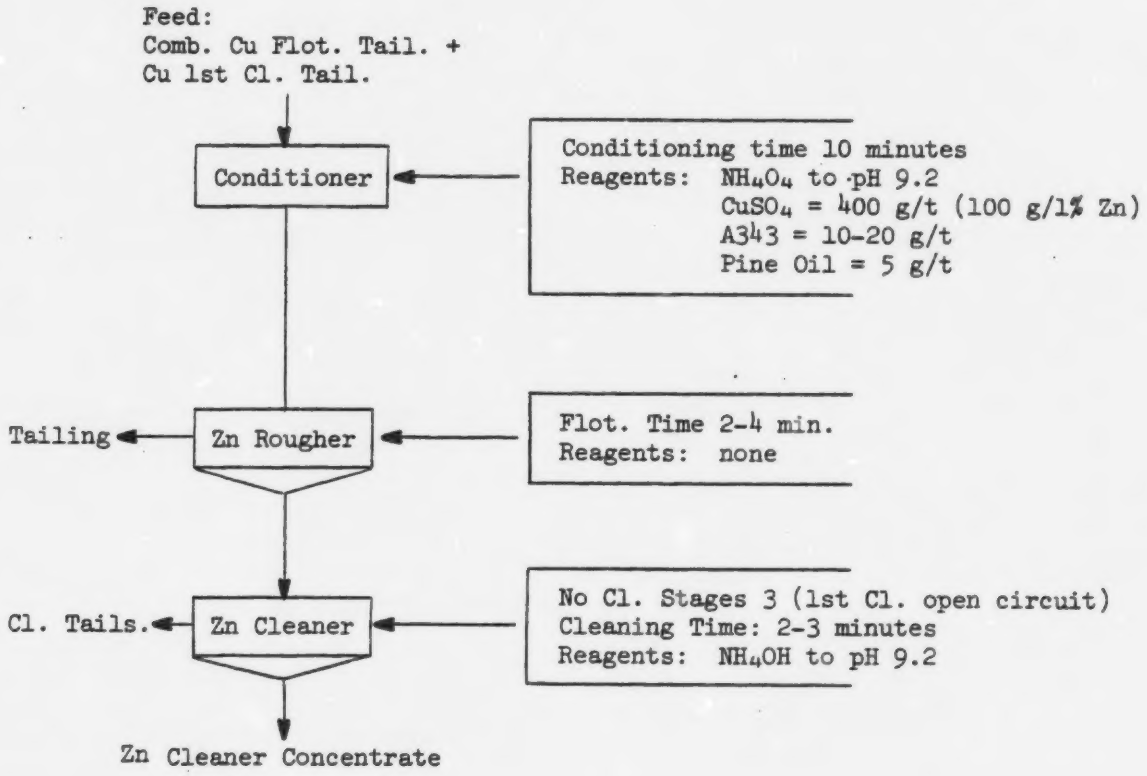
Discussion - Continued

2.2. Laboratory Test Procedure for Testing Cu-Zn Geco Ore - Cont'd

Figure No. 6 - Cont'd

Schematic Outline for Laboratory Procedure for Testing of Cu-Zn Geco Ore

b) Zinc Circuit (Standard)


Feed:
Comb. Cu Flot. Tail. +
Cu 1st Cl. Tail.
Conditioner
Conditioning time 10 minutes
Reagents: NH_4O_4 to pH 9.2
$CuSO_4$ = 400 g/t (100 g/1% Zn)
A343 = 10-20 g/t
Pine Oil = 5 g/t
Tailing
Zn Rougher
Flot. Time 2-4 min.
Reagents: none
Cl. Tails.
Zn Cleaner
No Cl. Stages 3 (1st Cl. open circuit)
Cleaning Time: 2-3 minutes
Reagents: NH_4OH to pH 9.2
Zn Cleaner Concentrate

Discussion - Continued

2.3. Typical Plant Metallurgical Results

Typical metallurgical results obtained at Geco concentrator are shown in Table No. 11.

Table No. 11

Concentrator Metallurgical Results (Letter, October 1982)

Product	Assays, %		% Distribution	
	Cu	Zn	Cu	Zn
Feed	1.75	3.6	100.0	100.0
Cu Concentrate	27-28	4.0- 4.5	90-93	4- 8
Zn Concentrate	0.4-0.8	52.0-55.0	1 to 2	80-85

2.4. Laboratory Testwork

Laboratory testwork on this sample was designed to evaluate the effect of organic depressant mixtures on copper and zinc flotation. In this testwork, an attempt was made to replace cyanide with organic depressants. The organic depressant mixtures were examined under different pH levels, collectors, cyanide and SO_2 additions.

Discussion - Continued

2.4.1. Copper Rougher Tests

2.4.1.1. Effect of Different LS Depressants on Copper Rougher Flotation

In a series of Tests 18 to 21, the effect of depressants LS1 to LS3 were compared with additions of cyanide. The conditions and results for these tests are shown in Table No. 12.

Table No. 12

Effect of Different LS Mixtures on Copper Flotation

a) Conditions

Test	Reagent Added, g/t							pH
No.	NH_4OH	A350	NaCN	LS-1	LS-2	LS-3	SO_2	
18	150	15	60	-	-	-	-	9.2
19	150	15	-	60	-	-	-	9.0
20	150	15	-	-	75	-	-	8.9
21	150	15	-	-	-	75	-	8.9

In most of the tests in which the LS mixtures were used, the pyrite flotation in the copper concentrate was excessive and low grade copper concentrates were produced. With addition of cyanide, the selectivity between copper and pyrite was maintained but at the expense of copper recovery.

Discussion - Continued

2.4.1.1. Effect of Different LS Depressants on Copper Rougher Flotation - Cont'd

Table No. 12 - Cont'd

Effect of Different LS Mixtures on Copper Flotation

b) Results

Test No.	Product	Weight %	Assays, %		% Distribution	
			Cu	Zn	Cu	Zn
18	Cu Ro. Conc. Cu Ro. Tail.	10.75 89.25	14.30 0.27	6.56 3.05	86.3 13.7	20.6 79.4
	Head(Calc.)	100.00	1.78	3.34	100.0	100.0
19	Cu Ro. Conc. Cu Ro. Tail.	25.49 74.51	6.64 0.10	5.92 2.78	94.3 4.6	42.1 57.9
	Head(Calc.)	100.00	1.77	3.58	100.0	100.0
20	Cu Ro. Conc. Cu Ro. Tail.	28.40 71.60	6.05 0.10	6.36 2.48	95.6 4.4	50.5 49.5
	Head(Calc.)	100.00	1.80	3.58	100.0	100.0
21	Cu Ro. Conc. Cu Ro. Tail.	27.88 72.12	5.97 0.11	6.04 2.54	95.2 4.8	47.9 52.1
	Head(Calc.)	100.00	1.75	3.52	100.0	100.0

Discussion - Continued

2.4.1.2. Effect of Different LS Depressants Using 50 g/t SO_2 and Reduced Collector Additions

In this series of tests, the effect of depressants LS1, LS2 and LS3 were examined with additions of 50 g/t SO_2 to the grind and reduced collector additions. The results for these tests are summarized in Table No. 13 (a,b) and graphically illustrated in Figure No. 7.

With additions of LS3 depressant in the presence of SO_2, coupled with lower collector addition, the copper rougher concentrate grade improved (Test No. 26).

Results obtained with LS1 and LS2 (Tests No. 27 and 28) were similar to those obtained in the previous series (Table No. 12). It should be noted that the initial rate of copper flotation with cyanide additions (see Figure No. 7) was much lower than with additions of LS depressants.

The overall rougher recovery, however was similar in all tests.

Table No. 13 - Effect of Different Organic Mixtures Using 50 g/t SO_2 and Lower Collector Additions

a) Conditions

Test No.	Reagent Additions, g/t							pH
	NH_4OH	SO_2	NaCN	LS-3	LS-1	LS-2	A350	
25	200	50	60	-	-	-	8	8.2
26	200	50	-	150	-	-	5	8.5
27	200	50	-	-	150	-	5	8.5
28	200	50	-	-	-	150	5	8.5

Discussion - Continued

2.4.1.2. Effect of Different LS Depressants Using 50 g/t SO_2 and Reduced Collector Additions - Cont'd

Table No. 13 - Effect of Different Organic Mixture Using 50 g/t SO_2 and Lower Collector Additions - Cont'd

b) Results

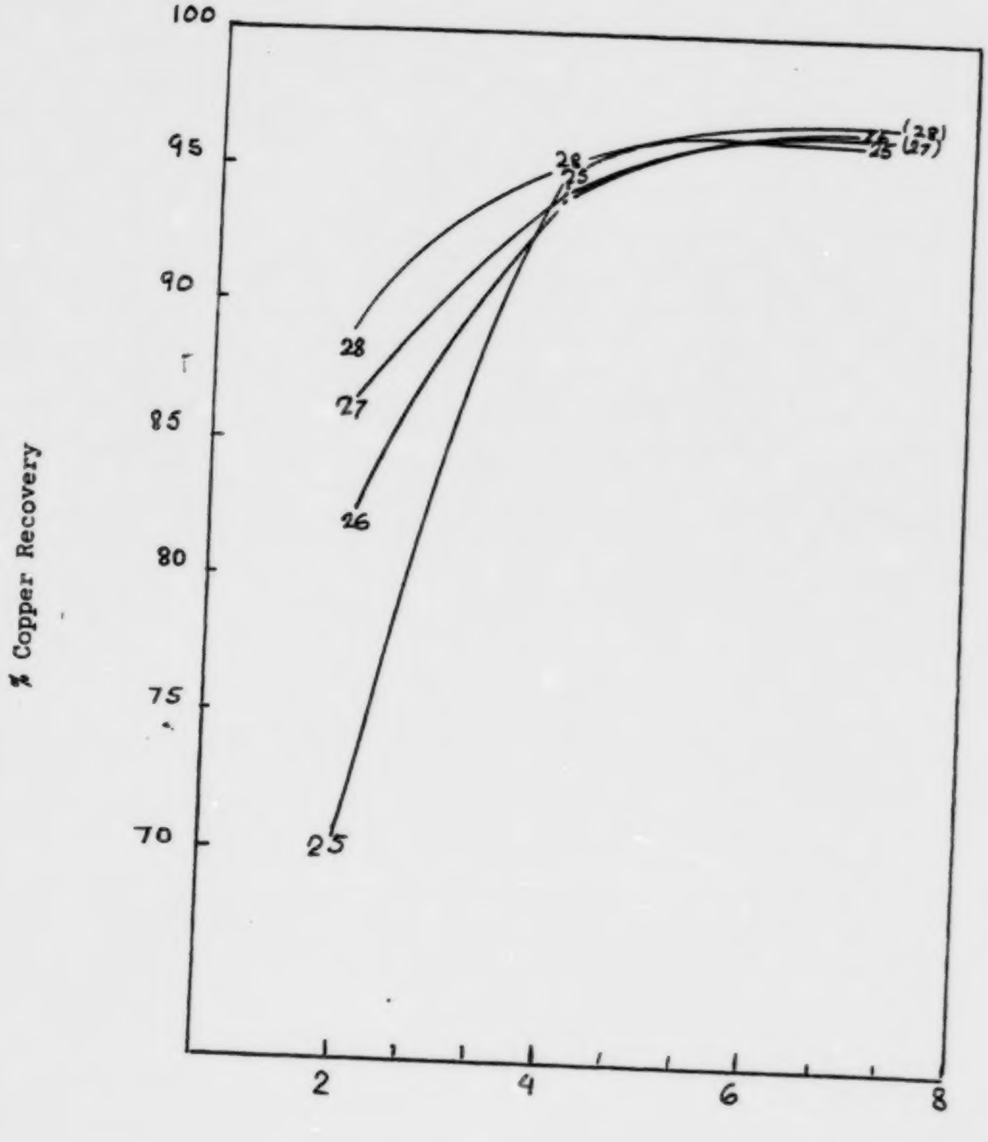
Test No.	Product	Weight %	Assays, %		% Distribution	
			Cu	Zn	Cu	Zn
25	Cu Rougher Conc.	10.36	16.9	8.91	95.0	25.3
	Cu Scav. Conc.	3.12	1.29	11.80	2.2	10.1
	Cu Ro.+Scav. Conc.	13.48	13.3	9.58	97.2	35.4
	Cu Flot. Tail.	86.52	0.059	2.72	2.8	64.6
	Head (Calc.)	100.00	1.84	3.65	100.0	100.0
26	Cu Rougher Conc.	11.17	15.5	10.3	94.2	31.5
	Cu Scav. Conc.	4.86	0.68	7.50	1.8	10.0
	Cu Ro.+Scav. Conc.	16.03	11.00	9.43	96.0	41.5
	Cu Flot. Tail.	83.97	0.087	2.53	4.0	58.5
	Head (Calc.)	100.00	1.83	3.63	100.0	100.0
27	Cu Rougher Conc.	16.47	10.10	6.09	94.7	27.6
	Cu Scav. Conc.	6.30	0.52	6.13	1.9	10.6
	Cu Ro.+Scav. Conc.	22.77	7.46	6.10	96.6	38.2
	Cu Flot. Tail.	77.23	0.079	2.90	3.4	61.8
	Head (Calc.)	100.00	1.76	3.63	100.0	100.0
28	Cu Rougher Conc.	19.88	8.34	6.09	95.4	33.6
	Cu Scav. Conc.	6.91	0.39	5.78	1.6	11.1
	Cu Ro.+Scav. Conc.	26.79	6.29	6.01	97.0	44.7
	Cu Flot. Tail.	73.21	0.072	2.72	3.0	55.3
	Head (Calc.)	100.00	1.74	3.60	100.0	100.0

Discussion - Continued

2.4.1.2. Effect of Different LS Depressants Using 50 g/t SO_2 and Reduced Collector Additions - Cont'd

Figure No. 7

Cu Recovery vs. Flotation Time - Effect of Different LS Depressants



Flotation Time, minutes

Discussion - Continued

2.4.1.3. Reproducibility Tests Using Cyanide and LS3 Depressant

Two tests using cyanide and two tests with LS3 depressant were conducted to examine the reproducibility of the procedure. The results for these tests are summarized in Table No. 14.

Table No. 14

Reproducibility Tests Using Cyanide and Organic Depressant LS3

Test No.	Test Procedure	Product	Weight %	Assays, %		% Distribution	
				Cu	Zn	Cu	Zn
25	NaCN=60 g/t	Cu Rougher Conc.	10.36	16.9	8.91	95.0	25.3
	SO_2=50 g/t	Cu Scav. Conc.	3.12	1.29	11.80	2.2	10.1
	pH=8.5	Cu Ro.+Scav. Conc.	13.48	13.30	9.58	97.2	35.4
	A350=8 g/t	Cu Flot. Tail.	86.52	0.059	2.72	2.8	64.6
		Head (Calc.)	100.00	1.84	3.65	100.0	100.0
34	NaCN=60 g/t	Cu Rougher Conc.	9.63	15.2	7.41	80.7	20.1
	SO_2=50 g/t	Cu Scav. Conc.	3.34	7.79	9.13	14.4	8.6
	pH=8.5	Cu Ro.+Scav. Conc.	12.97	13.3	7.86	95.1	28.7
	A350=8 g/t	Cu Flot. Tail.	87.03	0.10	2.92	4.9	71.3
		Head (Calc.)	100.00	1.81	3.56	100.0	100.0
26	LS-3=150 g/t	Cu Rougher Conc.	11.17	15.5	10.30	94.2	31.5
	SO_2=50 g/t	Cu Scav. Conc.	4.86	0.68	7.50	1.8	10.0
	pH=8.5	Cu Ro.+Scav. Conc.	16.03	11.00	9.43	96.0	41.5
	A350=5 g/t	Cu Flot. Tail.	83.97	0.087	2.53	4.0	58.5
		Head (Calc.)	100.00	1.83	3.63	100.0	100.0
35	LS-3=150 g/t	Cu Rougher Conc.	22.01	7.54	6.15	94.6	38.0
	SO_2=50 g/t	Cu Scav. Conc.	5.30	0.55	7.01	1.7	10.5
	pH=8.5	Cu Ro.+Scav. Conc.	27.31	6.18	6.31	96.3	48.5
	A350=5 g/t	Cu Flot. Tail.	72.69	0.088	2.52	3.7	51.5
		Head (Calc.)	100.00	1.75	3.55	100.0	100.0

The results obtained showed that with cyanide addition, the test was fairly reproducible (Test No. 25 and 34). The reproducibility of the tests with LS3 addition, however, was poor. It appeared that pyrite flotation was extremely sensitive to the level of collector addition when using organic depressants.

Discussion - Continued

2.4.1.4. Effect of Level of Collector Additions Using Cyanide or LS8 Depressant

This series of tests was designed to evaluate the effect of level of collector additions on the flotation of copper using either cyanide or LS8 depressant. In these tests, the collector strength was reduced from 1 % to 0.25 % to provide accurate additions. The conditions and results for these tests are summarized in Table No. 15 (a,b) and graphically illustrated in Figure No. 8.

Table No. 15

Effect of Level of Collector Additions Using LS8 or Cyanide - Comparison of Results

a) Conditions

Test No.	Reagent Additions, g/t					pH
	NH_4OH	NaCN	LS-8	A350	Pine Oil	
1	150	60	-	8	20	9.2
18	150	60	-	8	15	9.2
57	200	-	150	2	7.5	8.8
58	200	-	150	3	10	8.7
59	200	-	-	3	10	8.7
60	200	60	-	3	10	9.0
61	200	-	150	-	15	8.7
62	200	-	-	-	15	8.7

The results obtained indicated the following:

1. In the presence of 60 g/t cyanide and collector additions of 8 g/t (Test No. 1) the rougher concentrate grade and recovery was satisfactory. With the same rate of collector and cyanide additions as in Test No. 1, but slightly reduced pine oil additions (Test No. 18), copper rougher recovery was reduced by 10 %. When both collector and frother were reduced (Test No. 60) copper rougher recovery was only 65 %,

Discussion - Continued

2.4.1.4. Effect of Level of Collector Additions Using Cyanide or LS8 Depressant - Cont'd

Table No. 15 - Cont'd

Effect of Level of Collector Additions Using LS8 or Cyanide - Comparison of Results

b) Results

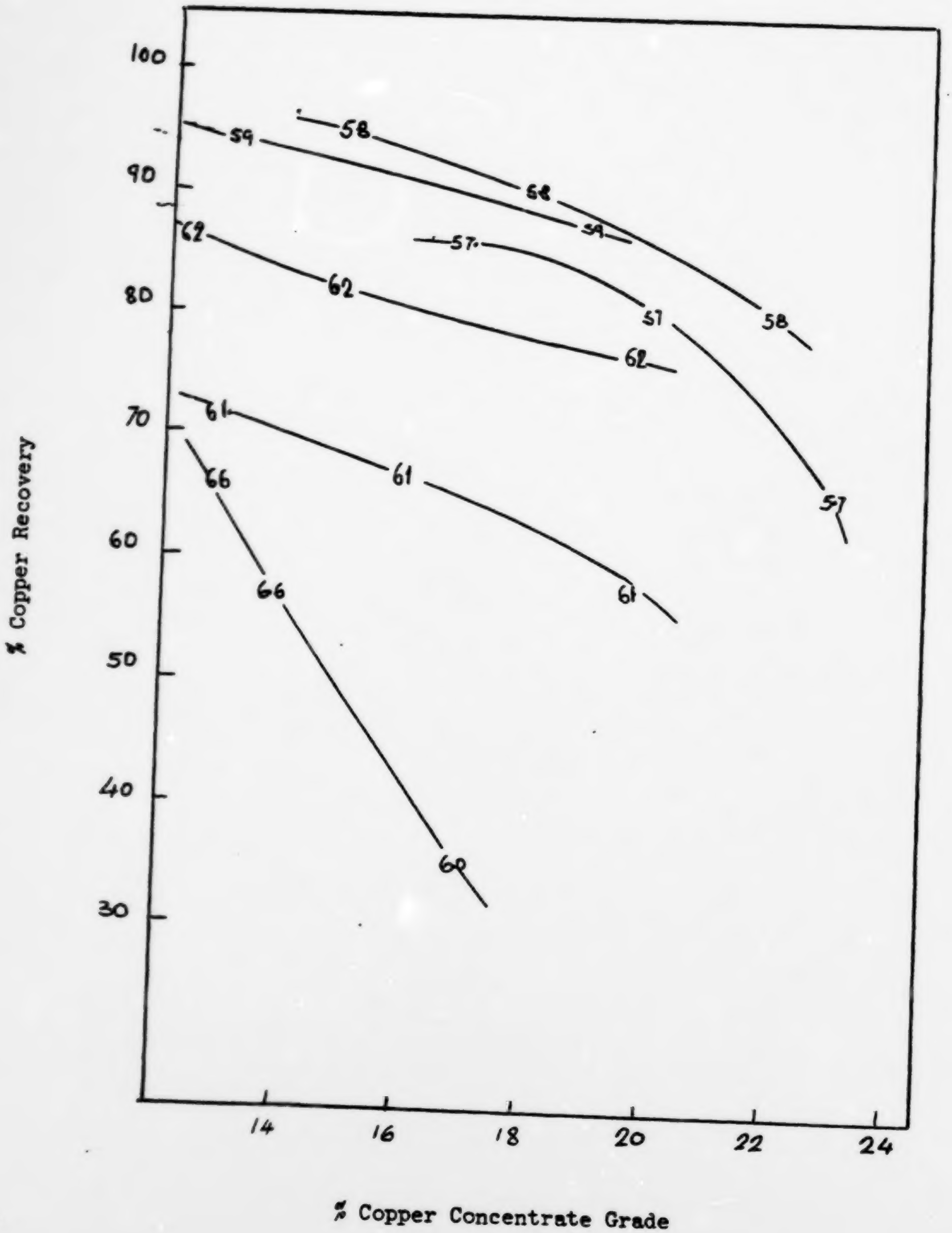
Test No.	Product	Weight %	Assays, %		% Distribution	
			Cu	Zn	Cu	Zn
1	Cu Ro. Conc. 1-3	11.29	14.7	6.96	96.0	23.0
	Cu Rougher Tail.	88.71	0.078	2.96	4.0	77.0
	Head (Calc.)	100.00	1.78	3.41	100.0	100.0
18	Cu Ro. Conc. 1	-	-	-	-	-
	Cu Ro. Conc. 1-3	10.75	14.3	6.56	86.3	20.6
	Cu Rougher Tail.	89.25	0.27	3.05	13.7	79.4
	Head (Calc.)	100.00	1.78	3.43	100.0	100.0
57	Cu Ro. Conc. 1	5.18	23.3	8.43	65.5	12.1
	Cu Ro. Conc. 1-3	8.98	17.88	9.88	86.1	24.6
	Cu Rougher Tail.	91.02	0.28	2.97	13.9	75.4
	Head (Calc.)	100.00	1.84	3.59	100.0	100.0
58	Cu Ro. Conc. 1	6.53	22.0	8.02	80.4	14.5
	Cu Ro. Conc. 1-3	11.24	15.11	9.52	95.1	29.6
	Cu Rougher Tail.	88.76	0.10	2.87	4.9	70.4
	Head (Calc.)	100.00	1.79	3.62	100.0	100.0
59	Cu Ro. Conc. 1	9.08	17.2	8.58	88.0	21.6
	Cu Ro. Conc. 1-3	15.84	10.78	8.69	96.3	38.3
	Cu Rougher Tail.	84.13	0.076	2.64	3.7	61.7
	Head (Calc.)	100.00	1.77	3.60	100.0	100.0
60	Cu Ro. Conc. 1	3.49	17.7	6.36	35.4	3.4
	Cu Ro. Conc. 1-3	8.51	13.54	5.64	65.9	14.1
	Cu Rougher Tail.	91.49	0.65	3.21	34.1	85.9
	Head (Calc.)	100.00	1.75	3.42	100.0	100.0
61	Cu Ro. Conc. 1	5.14	19.60	8.93	58.6	12.9
	Cu Ro. Conc. 1-3	9.31	13.12	8.96	71.0	23.4
	Cu Rougher Tail.	90.69	0.55	3.01	29.0	76.6
	Head (Calc.)	100.00	1.72	3.56	100.0	100.0
62	Cu Ro. Conc. 1	7.62	17.9	11.50	77.0	24.4
	Cu Ro. Conc. 1-3	12.36	12.3	10.73	85.7	37.0
	Cu Rougher Tail.	87.64	0.28	2.54	14.3	63.0
	Head (Calc.)	100.00	1.77	3.60	100.0	100.0

Discussion - Continued

2.4.1.4. Effect of Level of Collector Additions Using Cyanide or LS8 Depressant - Cont'd

Figure No. 8

Cu Grade vs. Recovery - Effect of Level of Collector



Discussion - Continued

2.4.1.4. Effect of Level of Collector Additions Using Cyanide or LS8 Depressant - Cont'd

2. Replacing cyanide with LS8 (Test No. 58) and using the same rate of collector and frother additions as in test No. 60, the copper grade and recovery was satisfactory. Even with no depressant additions and using only frother (Test No. 62), 85.7 % of the total copper was recovered in the copper rougher concentrate.

The results of these tests suggested that the efficiency of organic depressants is highly dependable on levels of collector and frother additions. In the presence of cyanide, however, the copper minerals were suppressed (Test No. 60 and 62) and required higher collector additions for high copper recovery.

2.4.1.5. Effect of LS Depressants Using Different pH Modifiers

In tests 53 to 58 and test 35, attempts were made to examine the effect of various LS depressants using different pH modifiers. Test No. 35 includes additions of 50 g/t SO_2 to the grinding stage.

The results and conditions for these tests are summarized in Table No. 30 (a, b).

The best results were obtained in test No. 58 with additions of 200 g/t NH_4OH and 150 g/t LS8. It appeared that the type of pH modifier tested had no significant effect on copper flotation.

Table No. 16 - Evaluation of Different Organic Depressant and pH Modifiers Preliminary Tests

a) Conditions

Test No.	Reagent Additions, g/t								pH
	NH_4OH	Na_2CO_3	SO_2	LS3	LS7	A350	Pine Oil	LS8	
35	200	-	50	150	-	5.0	15.0	-	8.5
53	200	-	-	150	-	3.5	12.5	-	8.8
54	-	1250	-	150	-	3.5	7.5	-	8.7
55	200	-	-	-	150	3.5	7.5	-	8.9
56	-	1200	-	-	150	3.5	7.5	-	8.8
58	200	-	-	-	-	3.5	7.5	150	8.8
									8.7

Discussion - Continued

2.4.1.5. Effect of LS Depressants Using Different pH Modifiers - Cont'd

Table No. 16 - Cont'd

Evaluation of Different Organic Depressant and pH Modifiers - Preliminary Tests

b) Results

Test No.	Product	Weight %	Assays, %		% Distribution	
			Cu	Zn	Cu	Zn
35	Cu Ro. Conc. 1	13.01	12.1	6.35	89.8	23.2
	Cu Ro. Conc. 1-3	27.31	6.18	6.31	96.3	48.5
	Cu Rougher Tail.	72.69	0.088	2.52	3.7	51.5
	Head (Calc.)	100.00	1.75	3.55	100.0	100.0
53	Cu Ro. Conc. 1	9.99	14.1	6.04	81.2	16.9
	Cu Ro. Conc. 1-3	17.68	9.43	6.98	96.1	34.5
	Cu Rougher Tail.	82.32	0.082	2.84	3.9	65.5
	Head (Calc.)	100.00	1.73	3.57	100.0	100.0
54	Cu Ro. Conc. 1	12.16	11.20	3.66	77.9	12.4
	Cu Ro. Conc. 1-3	26.17	6.34	4.80	94.9	35.1
	Cu Rougher Tail.	73.83	0.12	3.14	5.1	64.9
	Head (Calc.)	100.00	1.75	3.57	100.0	100.0
55	Cu Ro. Conc. 1	10.25	14.9	6.67	87.2	19.4
	Cu Ro. Conc. 1-3	18.78	8.96	6.84	96.0	36.5
	Cu Rougher Tail.	81.22	0.085	2.75	4.0	63.5
	Head (Calc.)	100.00	1.75	3.51	100.0	100.0
56	Cu Ro. Conc.1	9.41	15.1	6.01	79.7	15.4
	Cu Ro. Conc. 1-3	19.94	8.5	5.72	95.1	31.1
	Cu Rougher Tail.	80.03	0.11	3.14	4.9	68.9
	Head (Calc.)	100.00	1.78	3.66	100.0	100.0
58	Cu Ro. Conc. 1	6.53	22.0	8.02	80.4	14.5
	Cu Ro. Conc. 1-3	11.24	15.11	9.52	95.1	29.6
	Cu Rougher Tail.	88.76	0.10	2.87	4.9	70.6
	Head (Calc.)	100.00	1.79	3.62	100.0	100.0

Discussion - Continued

2.4.1.6. Effect of LS Depressants Using Lower pH (8.5)

In these tests depressant LS4, LS5 and LS6 were tested at lower pH (8.5). The results and conditions for these tests are summarized in Table No. 17 (a,b).

Table No. 17

Effect of Different Organic Depressants - Comparison of Results

a) Conditions

Test No.	Reagent Additions, g/t						pH
	NH_4OH	NaCN	LS4	LS5	LS6	A350	
25	200	60	-	-	-	8	8.5
30	175	-	150	-	-	5	8.5
31	170	-	-	150	-	5	8.5
32	150	-	-	-	150	5	8.5

Discussion - Continued

2.4.1.6. Effect of LS Depressants Using Lower pH (8.5) - Cont'd

Table No. 17 - Cont'd

Effect of Different Organic Depressants - Comparison of Results

b) Conditions

Test No.	Product	Weight %	Assays, %		% Distribution	
			Cu	Zn	Cu	Zn
25	Cu Rougher Conc.	10.36	16.90	8.91	95.0	25.3
	Cu Scav. Conc.	3.12	1.29	11.80	2.2	10.1
	Cu Ro.+Scav. Conc.	13.48	13.3	9.58	97.2	35.4
	Cu Flot. Tail.	86.52	0.059	2.72	2.8	64.6
	Head (Calc.)	100.00	1.84	3.65	100.0	100.0
30	Cu Rougher Conc.	21.77	7.54	6.24	95.2	38.2
	Cu Scav. Conc.	6.61	0.40	5.95	1.5	11.1
	Cu Ro.+Scav. Conc.	28.38	5.87	6.17	96.7	49.3
	Cu Flot. Tail.	71.62	0.079	2.52	3.3	50.7
	Head (Calc.)	100.00	1.72	3.50	100.0	100.0
31	Cu Rougher Conc.	23.67	6.90	6.27	95.2	41.6
	Cu Scav. Conc.	6.04	0.45	6.22	1.6	10.5
	Cu Ro.+Scav. Conc.	29.71	5.59	6.26	96.8	52.1
	Cu Flot. Tail.	70.29	0.079	2.43	3.2	47.9
	Head (Calc.)	100.00	1.72	3.57	100.0	100.0
32	Cu Rougher Conc.	23.03	7.11	5.41	94.4	34.7
	Cu Scav. Conc.	6.53	0.48	6.63	1.8	12.1
	Cu Ro.+Scav. Conc.	29.56	5.65	5.68	96.2	46.8
	Cu Flot. Tail.	70.44	0.093	2.71	3.8	53.2
	Head (Calc.)	100.00	1.74	3.59	100.0	100.0

The results obtained indicated that depressants LS4, 5 and 6 were not effective for pyrite depression.

Discussion - Continued

2.4.2. Copper Cleaning Tests

2.4.2.1. Effect of pH on Copper Cleaning

Initial copper cleaning tests were performed to examine the effect of pH during cleaning on copper upgrading. The results for these tests are summarized in Table No. 18.

Table No. 18

Copper Cleaning Tests Using LS8 - Effect of pH

Test	pH		Product	Weight	Assays, %		% Distribution	
No.	Ro.	Cl.		%	Cu	Zn	Cu	Zn
78	8.9	4.5	Cu Cl. Conc.	5.32	26.6	3.47	80.9	5.1
			Cu Ro. Conc.	13.91	11.65	8.05	92.7	31.0
			Cu Flot. Tail.	86.09	0.13	2.89	7.3	69.0
			Head (Calc.)	100.00	1.75	3.61	100.0	100.0
75	8.8	5.5	Cu Cl. Conc.	6.78	23.70	7.29	88.4	13.9
			Cu Ro. Conc.	24.05	7.21	5.62	95.4	37.9
			Cu Flot. Tail.	75.95	0.11	2.91	4.6	62.1
			Head (Calc.)	100.00	1.82	3.56	100.0	100.0
79	8.9	6.5	Cu Cl. Conc.	5.94	25.40	8.77	86.8	15.2
			Cu Ro. Conc.	12.94	12.69	7.06	94.5	26.6
			Cu Flot. Tail.	86.06	0.11	2.89	5.5	73.4
			Head (Calc.)	100.00	1.74	3.43	100.0	100.0

The results obtained indicated that cleaning pH had a significant effect on copper-zinc selectivity and recovery in the copper cleaning. At pH 4.5, the selectivity between copper and zinc minerals was satisfactory, but the copper recovery was only 80.9 % Cu. At the higher pH (i.e. 5.5 and 6.5) copper recovery increased but selectivity between copper and zinc deteriorated.

2.4.2.2. Effect of Different LS3 Compositions on Copper Flotation and Upgrading

Four copper rougher and cleaning tests were conducted to examine the effect of LS3 depressant composition on copper flotation and cleaning. In these tests the ratio of LSH D1902 and $ZnSO_4$ was changed as shown in Table No. 10. The results and conditions for these tests are shown in Table No. 19 and graphically illustrated in Figure No. 9.

The highest copper cleaner recovery was obtained in Test No. 94 with the standard LS3 depressant mixture, but the zinc content of the copper concentrate was high (5.54 % Zn). Using altered LS3 mixtures (LS3A and LS3C) as in test No. 95 and 97, the zinc rejection in the copper concentrate improved but the copper final recovery was reduced.

Discussion - Continued

2.4.2.2. Effect of Different LS3 Compositions on Copper Flotation and Upgrading - Cont'd

Table No. 19

Copper Cleaning Tests Using LS3 Depressant - Effect of Different LS3 Composition (Cleaning pH=4.5)

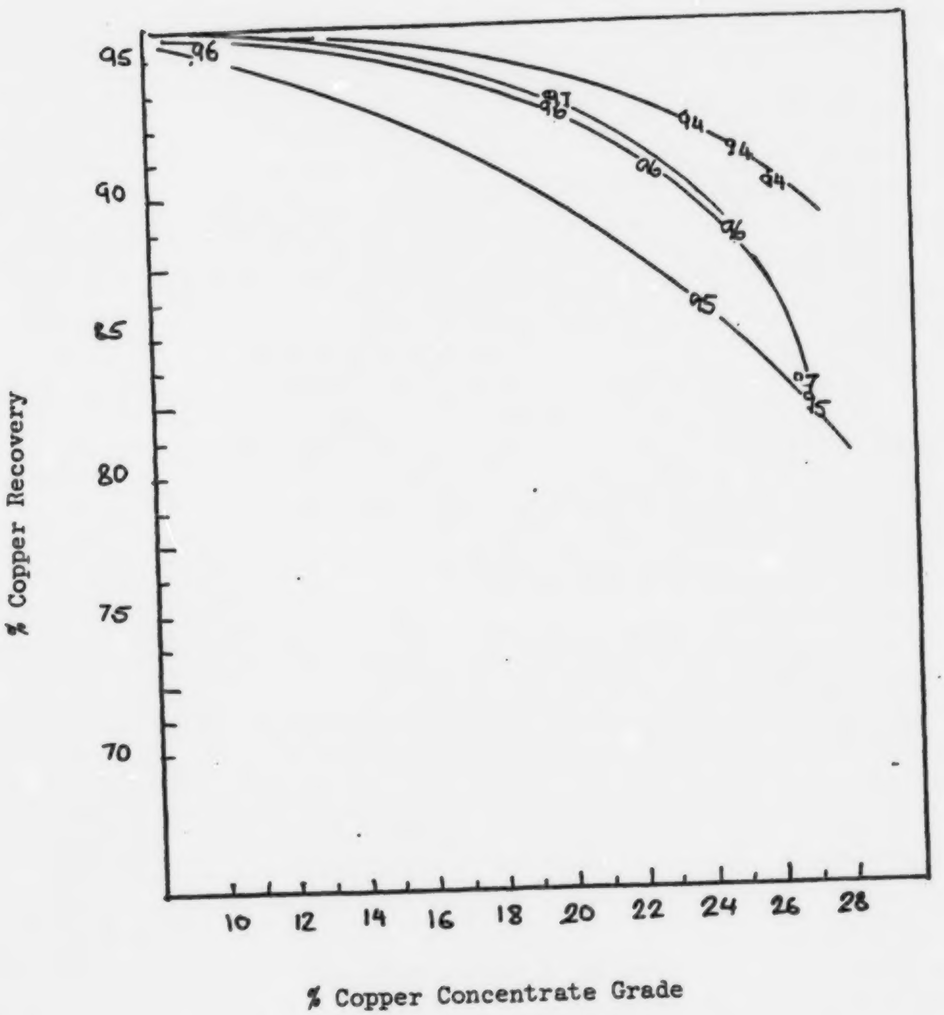
Test No.	Depressant Used	Product	Weight %	Assays, %		% Distribution	
				Cu	Zn	Cu	Zn
94	LS3	Cu Cl. Conc.	6.06	26.2	5.54	90.4	9.3
		Cu Ro. Conc.	13.12	12.77	7.65	95.5	27.8
		Cu Flot. Tail.	86.88	0.091	3.00	4.5	72.2
		Head (Calc.)	100.00	1.75	3.61	100.0	100.0
96	LS3B	Cu Cl. Conc.	6.14	25.0	5.44	88.7	9.5
		Cu Ro. Conc.	16.14	10.21	6.15	95.5	28.3
		Cu Flot. Tail.	83.86	0.10	2.99	4.5	71.7
		Head (Calc.)	100.00	1.73	3.50	100.0	100.0
95	LS3A	Cu Cl. Conc.	5.46	27.15	2.94	82.4	4.4
		Cu Ro. Conc.	17.36	9.83	5.98	94.9	28.7
		Cu Flot. Tail.	82.64	0.11	3.10	5.1	71.3
		Head (Calc.)	100.00	1.79	3.59	100.0	100.0
97	LS3C	Cu Cl. Conc.	5.36	27.5	2.77	83.1	4.1
		Cu Ro. Conc.	14.27	11.94	8.02	96.0	31.4
		Cu Flot. Tail.	85.73	0.081	2.91	4.0	68.6
		Head (Calc.)	100.00	1.77	3.63	100.0	100.0

Discussion - Continued

2.4.2.2. Effect of Different LS3 Compositions on Copper Flotation and Upgrading - Cont'd

Figure No. 9

Cu Grade vs. Cu Recovery - Effect of pH on Copper Cleaning



Discussion - Continued

2.4.3. Complete Flotation Tests - Effect of Organic LS3 Depressants - Comparison of Results

A series of six tests was performed to compare the effect of LS3 depressant on the copper and zinc metallurgical results. Comparison tests were conducted with organic depressant LS3, with additions of cyanide and without depressant. The results of these tests are compared in Table No. 20.

From the results obtained the net effects of the organic depressant on copper-zinc metallurgical results could be summarized as follows:

1. With the use of the organic mixture, the cyanide addition could be eliminated from the circuit without deterioration in the metallurgical results.
2. With additions of LS3 depressant the overall copper recovery was higher than that obtained with additions of cyanide, because in the presence of cyanide, copper minerals are suppressed.
3. Collector requirements could be reduced by 25 % to 50 % when using organic LS3 depressant, because the rate of copper flotation with LS3 depressant was much higher than with cyanide.
4. Additions of LS3 depressant to the copper circuit had a beneficial effect on subsequent zinc flotation.

2.4.3. Complete Flotation Tests - Effect of Organic LS3 Depressants - Comparison of Results

Table No. 20 - Evaluation of Organic Depressant LS3 - Full Scale Tests

Test	Depressant Used g/t		Product	Weight	Assays, %		% Distribution	
No.	NaCN	DS3		%	Cu	Zn	Cu	Zn
99	0	150	Cu 3rd Cl. Conc.	6.05	25.50	2.68	87.5	4.7
			Cu 1st Cl. Conc.	8.50	19.58	6.30	94.3	15.0
			Zn 3rd Cl. Conc.	5.02	0.65	54.20	1.8	80.0
			Zn Rougher Conc.	10.82	0.57	25.85	3.4	81.8
			Zn Flot. Tail.	80.68	0.046	0.13	2.3	3.2
			Head (Calc.)	100.00	1.76	3.44	100.0	100.0
105	0	150	Cu 3rd Cl. Conc.	5.69	27.60	2.58	88.2	4.0
			Cu 1st Cl. Conc.	7.76	21.53	5.63	93.8	12.0
			Zn 3rd Cl. Conc.	5.29	0.60	55.30	1.8	80.7
			Zn Rougher Conc.	13.78	0.52	22.20	4.1	84.5
			Zn Flot. Tail.	78.46	0.047	0.16	2.1	3.5
			Head (Calc.)	100.00	1.78	3.62	100.0	100.0
110	0	0	Cu 3rd Cl. Conc.	8.11	20.20	5.65	91.4	12.7
			Cu 1st Cl. Conc.	10.59	15.95	9.07	94.3	26.6
			Zn 3rd Cl. Conc.	4.56	0.63	54.10	1.6	68.7
			Zn Rougher Conc.	23.15	0.33	11.06	4.2	71.2
			Zn Flot. Tail.	66.26	0.04	0.12	1.5	2.2
			Head (Calc.)	100.00	1.79	3.60	100.0	100.0
111	0	0	Cu 3rd Cl. Conc.	8.30	20.00	5.72	92.2	13.1
			Cu 1st Cl. Conc.	10.71	16.00	8.57	95.3	25.4
			Zn 3rd Cl. Conc.	4.65	0.57	5.380	1.5	69.2
			Zn Rougher Conc.	11.15	0.51	23.23	3.1	71.8
			Zn Flot. Tail.	78.14	0.037	0.13	1.6	2.8
			Head (Calc.)	100.00	1.80	3.61	100.0	100.0
112	60	0	Cu 3rd Cl. Conc.	5.56	27.90	3.56	85.7	5.4
			Cu 1st Cl. Conc.	6.95	23.09	7.00	88.7	11.6
			Zn 3rd Cl. Conc.	5.33	1.48	55.40	5.2	81.2
			Zn Rougher Conc.	21.62	0.81	14.39	9.6	85.5
			Zn Flot. Tail.	71.43	0.041	0.14	1.7	2.8
			Head (Calc.)	100.00	1.81	3.63	100.0	100.0
113	60	0	Cu 3rd Cl. Conc.	5.31	27.90	3.50	85.4	5.4
			Cu 1st Cl. Conc.	6.87	22.43	6.05	88.8	12.0
			Zn 3rd Cl. Conc.	5.25	1.48	54.50	4.5	82.9
			Zn Ro. Conc.	26.40	0.65	11.21	9.2	85.5
			Zn Flot. Tail.	66.73	0.05	0.11	2.0	2.2
			Head (Calc.)	100.00	1.73	3.45	100.0	100.0

Discussion - Continued

3. Evaluation of Organic LS Depressants on Cu-Zn Ore From Kidd Creek Mines Limited

3.1. Description of Sample Used for Flotation Testwork

The copper-zinc ore used in this testwork was rod mill feed from section A of the Kidd Creek concentrator. The head analysis of the laboratory sample was as follows:

Copper (Cu) =	2.66 %
Lead (Pb) =	0.16 %
Zinc (Zn) =	4.42 %
Iron (Fe) =	13.40 %
Sulphur (S) =	10.6 %
Gold (Au) =	0.05 g/t
Silver (Ag) =	47.9 g/t

The Kidd Creek Cu-Zn ore is a siliceous copper ore containing stringers of chalcopyrite in a cherty breccia with occurrences of massive chalcopyrite and sphalerite-pyrite. Most of the copper occurring in this ore is finely disseminated throughout the gangue and to some extent with pyrite.

3.2. Laboratory Procedure for Testing of Kidd Creek Cu-Zn Ore

The laboratory procedure for testing of Kidd Creek Cu-Zn ore is outlined in Figure No. 10 (a,b). This flowsheet is slightly different from that of the operating plant as shown in Figure No. 11.

During the evaluation of LS depressants, the depressants were usually added to the grind and copper regrind and cleaning stages.

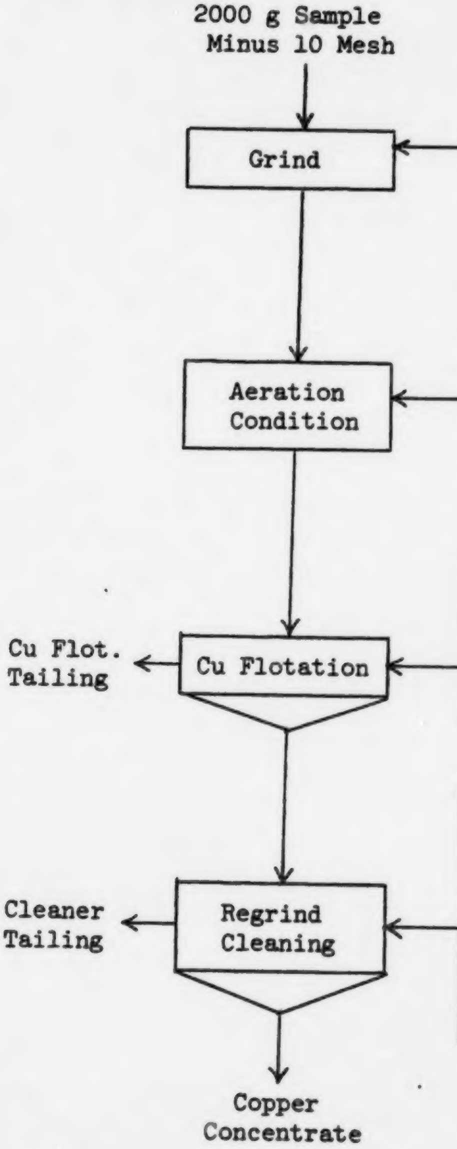
Discussion - Continued

3.2. Laboratory Procedure for Testing of Kidd Creek Ore Cu-Zn Ore - Cont'd

Figure No. 10

Schematic Outline of Laboratory Procedure for Testing Cu-Zn Kidd Creek Ore

a) Cu Circuit


2000 g Sample
Minus 10 Mesh
Grind
Aeration
Condition
Cu Flot.
Tailing
Cu Flotation
Cleaner
Tailing
Regrind
Cleaning
Copper
Concentrate

	Standard	Variables
Grind	Grind to 80%-325 mesh Water: 1200 mL Reagent: none Grinding Mill: Ball	Reagents: LS, SO_2 and CaO additions to grinding step.
Aeration Condition	Aeration Time: 10 min. Reagents to Aeration: SO_2 = 80 g/t Conditioning Time: 3 min. Reagents to Cond.: CaO to pH 10.0 R208 = 10 g/t	Level of SO_2, lime and collector additions.
Cu Flotation	Flot. Time: 6-10 min. Reagents: R208=10-20 g/t A317=8-10 g/t MIBC=20 g/t pH = 8.5	Level of collector pH Flotation Time
Regrind Cleaning	Regrind: Pebble Mill, 10-20 minutes Reagents: SO_2=470-600 g/t CaO=0-200 g/t R208=2-7 g/t R217=2-5 g/t MIBC= as required pH = 5.5 to 6.5	Level of LS addition pH Regrind Time

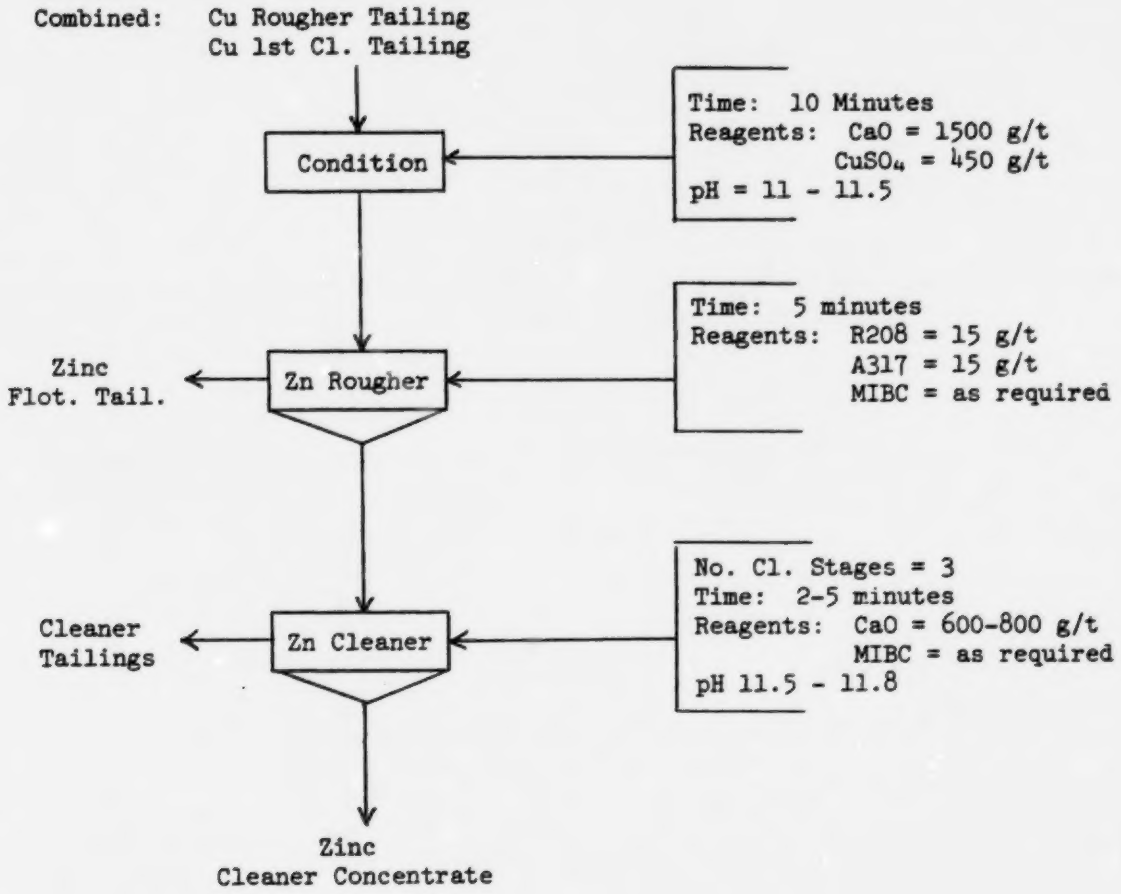
Discussion - Continued

3.2. Laboratory Procedure for Testing of Kidd Creek Ore Cu-Zn Ore - Cont'd

Figure No. 10 - Cont'd

Schematic Outline of Laboratory Procedure for Testing Cu-Zn Kidd Creek Ore

b) Zinc Circuit

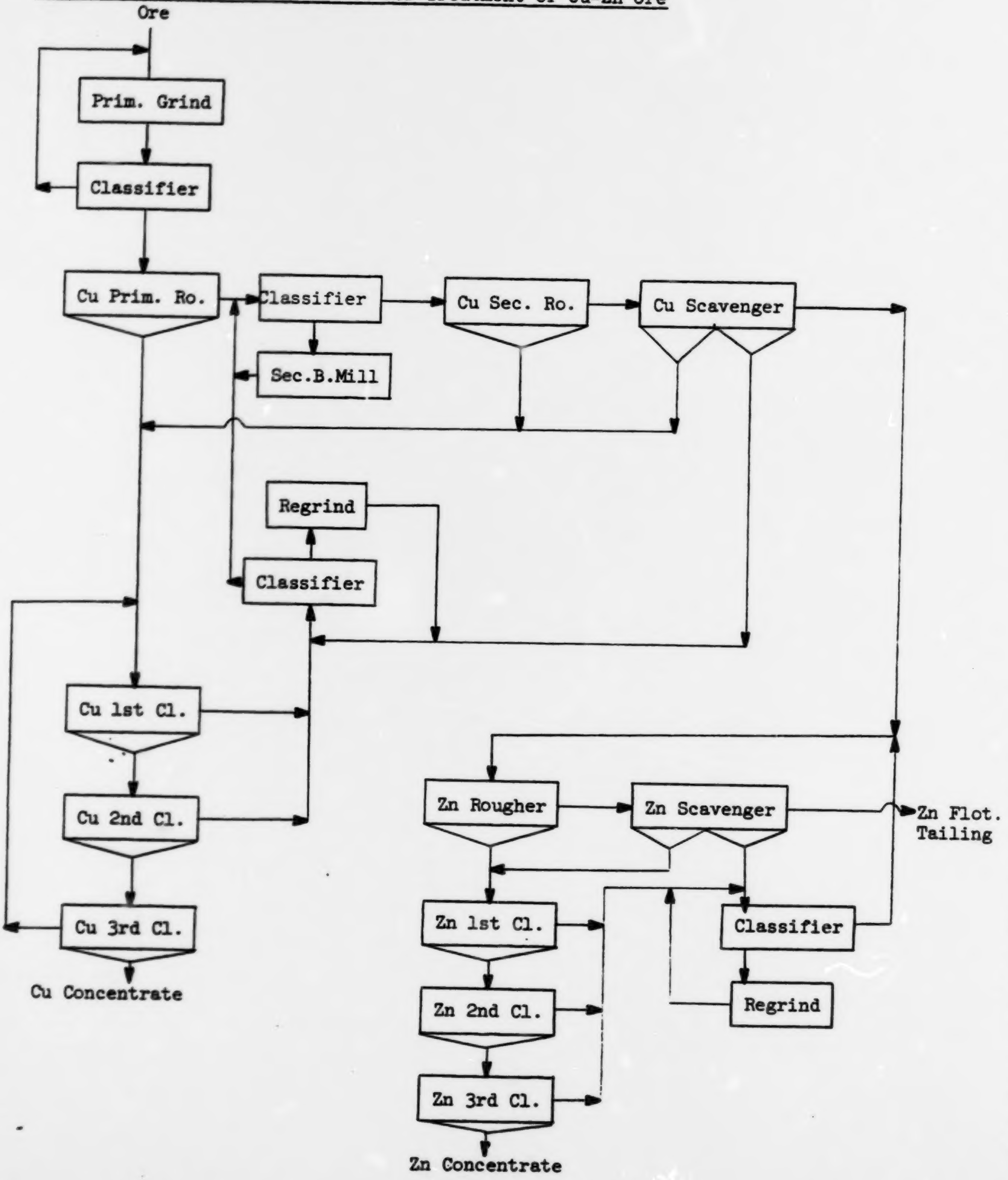

Combined: Cu Rougher Tailing
Cu 1st Cl. Tailing
Condition
Time: 10 Minutes
Reagents: CaO = 1500 g/t
CuSO₄ = 450 g/t
pH = 11 - 11.5
Time: 5 minutes
Reagents: R208 = 15 g/t
A317 = 15 g/t
MIBC = as required
Zinc Flot. Tail.
Zn Rougher
No. Cl. Stages = 3
Time: 2-5 minutes
Reagents: CaO = 600-800 g/t
MIBC = as required
pH 11.5 - 11.8
Cleaner Tailings
Zn Cleaner
Zinc Cleaner Concentrate

Discussion - Continued

3.2. Laboratory Procedure for Testing of Kidd Creek Ore Cu-Zn Ore - Cont'd

Figure No. 11

Standard Concentrator Flowsheet for Treatment of Cu-Zn Ore


Ore
Prim. Grind
Classifier
Cu Prim. Ro.
Classifier
Cu Sec. Ro.
Cu Scavenger
Sec.B.Mill
Regrind
Classifier
Cu 1st Cl.
Cu 2nd Cl.
Cu 3rd Cl.
Cu Concentrate
Zn Rougher
Zn Scavenger
Zn Flot. Tailing
Zn 1st Cl.
Zn 2nd Cl.
Zn 3rd Cl.
Classifier
Regrind
Zn Concentrate

Discussion - Continued

3.3. Typical Plant Metallurgical Results

Typical metallurgical results obtained on Cu-Zn ore in the Kidd Creek concentrator are shown in Table No. 21.

Table No. 21

Concentrator Metallurgical Results on Kidd Creek Cu-Zn Ore

Product	Assays, %			% Distribution		
	Cu	Zn	Ag	Cu	Zn	Ag
Head	2.25	6.84	51.0	100.0	100.0	100.0
Cu Concentrate	24.16	5.43	455.0	94.9	7.0	78.1
Zn Concentrate	0.47	54.54	43.0	2.3	87.3	9.1
Final Tailing	0.08	0.48	8.0	2.8	5.7	12.8

Discussion - Continued

3.4. Laboratory Testwork - Evaluation of LS Depressants

3.4.1. Effect of LS Depressants on Copper Flotation and Cleaning

A series of six flotation tests was conducted to examine the effect of different LS depressants in the copper rougher and cleaning stages. Depressants LS1, LS2, LS3, LS7 and LS8 were included in these tests. The conditions and results for these tests are summarized in Table No. 22.

Table No. 22

Effect of Different LS Depressants on Copper Flotation From Texas Gulf Cu-Zn Ore

a) Conditions

Test No.	Reagent Additions, g/t						
	SO_2	CaO	LS-1	LS-2	LS-3	LS-7	LS-8
131	1250	2175	-	-	-	-	-
132	1180	2375	200	-	-	-	-
133	1170	2370	-	200	-	-	-
134	1170	2370	-	-	200	-	-
135	1170	2370	-	-	-	200	-
136	1170	2370	-	-	-	-	200

From the results obtained the following observations can be made:

1. Without LS depressant additions (Test No. 131), a high copper recovery was obtained, but the copper concentrate grade was low.
2. The addition of organic depressants improved the copper concentrate grade in the cleaning but the copper recovery was reduced.
3. The types of LS depressants tested had no significant effect on copper flotation and cleaning.

Discussion - Continued

3.4.1. Effect of LS Depressants on Copper Flotation and Cleaning - Cont'd

Table No. 22 - Cont'd

Effect of Different LS Depressants on Copper Flotation From Texas Gulf Cu-Zn Ore

b) Results

Test No.	Product	Weight %	Assays, %		% Distribution	
			Cu	Zn	Cu	Zn
131	Cu Cl. Conc.	12.40	20.4	5.38	93.9	14.8
	Cu Ro. Conc.	26.41	9.78	5.29	95.9	30.9
	Cu Flot. Tail.	73.59	0.15	4.22	4.1	69.1
	Head (Calc.)	100.00	2.69	4.50	100.0	100.0
132	Cu Cl. Conc.	10.18	23.6	4.07	88.3	9.2
	Cu Ro. Conc.	25.59	10.05	5.08	94.6	28.9
	Cu Flot. Tail.	74.41	0.20	4.31	5.4	71.1
	Head (Calc.)	100.00	2.72	4.51	100.0	100.0
133	Cu Cl. Conc.	10.21	23.8	4.34	88.6	9.7
	Cu Ro. Conc.	24.51	10.63	5.27	95.0	28.2
	Cu Flot. Tail.	75.49	0.18	4.36	5.0	71.8
	Head (Calc.)	100.00	2.74	4.58	100.0	100.0
134	Cu Cl. Conc.	9.88	24.7	4.38	88.9	9.9
	Cu Ro. Conc.	20.92	12.25	5.01	93.4	24.0
	Cu Flot. Tail.	79.08	0.23	4.19	6.6	76.0
	Head (Calc.)	100.00	2.75	4.36	100.0	100.0
135	Cu Cl. Conc.	10.01	24.7	4.65	88.2	10.4
	Cu Ro. Conc.	21.33	12.30	5.78	93.6	25.6
	Cu Flot. Tail.	78.67	0.23	4.42	6.4	74.4
	Head (Calc.)	100.00	2.80	4.48	100.0	100.0
136	Cu Cl. Conc.	10.03	24.2	4.29	87.3	9.5
	Cu Ro. Conc.	23.24	11.21	5.31	93.6	27.3
	Cu Flot. Tail.	76.76	0.23	4.27	6.4	72.7
	Head (Calc.)	100.00	2.78	4.51	100.0	100.0

Discussion - Continued

3.4.2. Effect of Levels of Lime and SO_2 Additions With and Without Presence of LS3 Depressant

Five tests were carried out with and without LS3 additions with different levels of lime and SO_2 additions. The results and conditions for these tests are summarized in Table No. 23 and graphically illustrated in Figure No. 12.

When using depressant LS3 and lower lime and SO_2 additions, the copper concentrate was much higher grade than that obtained with higher lime and SO_2 additions (Test No. 134). The lower additions of lime and SO_2 without the presence of LS3 depressant (Test No. 140), resulted in a significant reduction in the selectivity between copper and zinc minerals. In addition, pyrite flotation in the copper rougher and cleaning was strong. This suggested that additions of LS3 depressant at lower lime and SO_2 additions had beneficial effects on copper flotation and selectivity. Without LS3 depressant, both lime and SO_2 have to be kept high to maintain selectivity.

Table No. 23

Effect of Levels of SO_2 and CaO on Copper Flotation Using LS3 Depressant

a) Conditions

Test	Reagent Added, grams per tonne			pH	
No.	SO_3	CaO	LS3	Ro.	Cl.
131	1250	2175	-	10.5	6.5
134	1170	2370	200	10.5	6.5
138	800	890	200	9.8	6.9
140	1070	800	-	10.2	6.0
148	1320	1200	-	8.4	5.5

Discussion - Continued

3.4.2. Effect of Levels of Lime and SO_2 Additions With and Without Presence of LS3 Depressant - Cont'd

Table No. 23 - Cont'd

b) Results

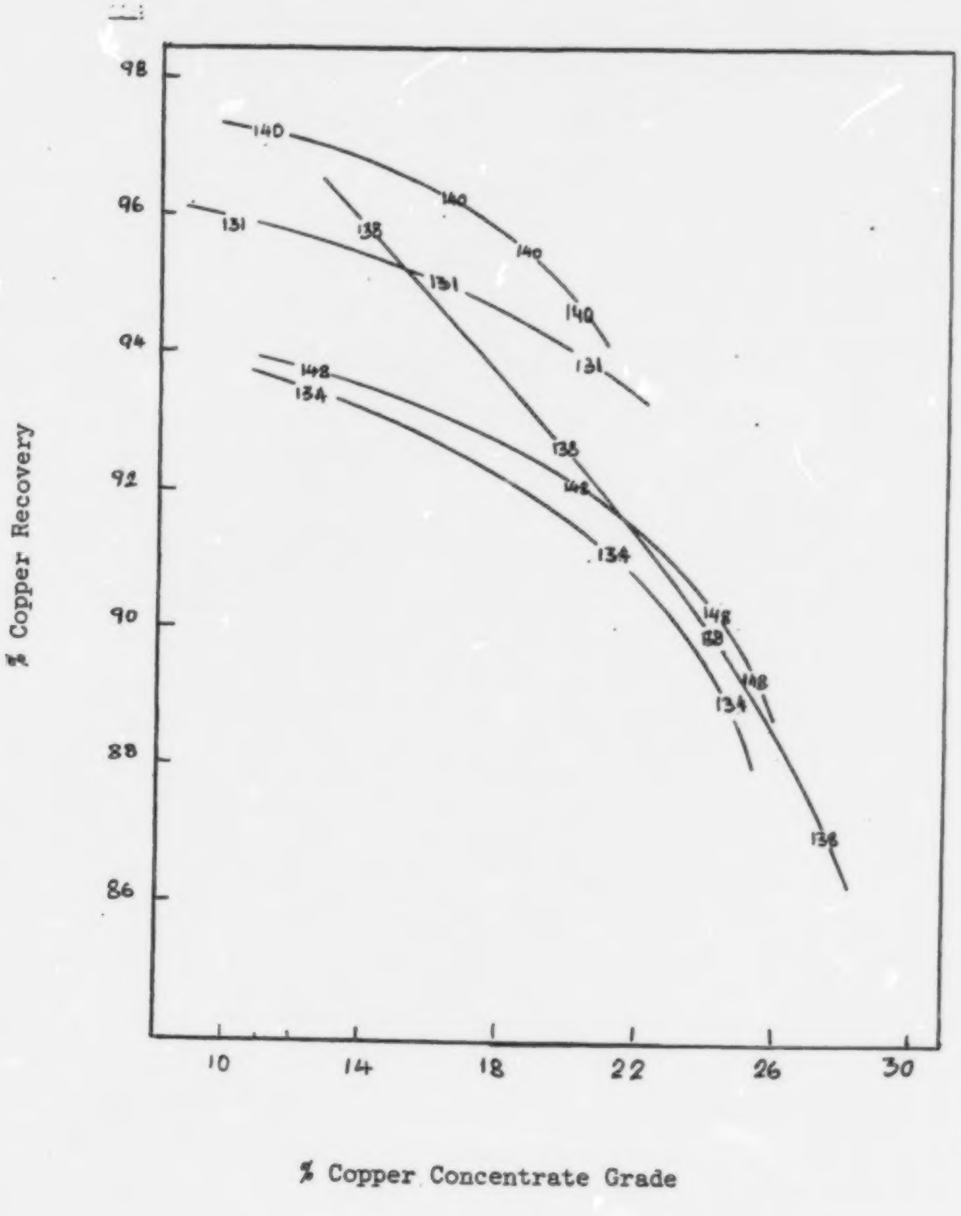
Test No.	Product	Weight %	Assays, %		% Distribution	
			Cu	Zn	Cu	Zn
131	Cu Cl. Conc.	12.40	20.40	5.38	93.9	14.8
	Cu Ro. Conc.	26.41	9.78	5.28	95.9	30.9
	Cu Flot. Tail.	73.59	0.15	4.22	4.1	69.1
	Head (Calc.)	100.00	2.69	4.50	100.0	100.0
134	Cu Cl. Conc.	9.88	24.70	4.38	88.9	9.9
	Cu Ro. Conc.	20.92	12.25	5.01	93.4	24.0
	Cu Flot. Tail.	79.08	0.23	4.19	6.6	76.0
	Head (Calc.)	100.00	2.75	4.36	100.0	100.0
138	Cu Cl. Conc.	8.84	27.5	5.75	87.0	11.3
	Cu Ro. Conc.	18.95	14.17	7.91	95.9	33.4
	Cu Flot. Tail.	81.05	0.15	3.70	4.1	66.6
	Head (Calc.)	100.00	2.81	4.50	100.0	100.0
140	Cu Cl. Conc.	12.72	20.4	11.0	94.6	31.9
	Cu Ro. Conc.	23.01	11.6	10.2	97.2	53.4
	Cu Flot. Tail.	76.99	0.10	2.65	2.8	46.6
	Head (Calc.)	100.00	2.74	4.38	100.0	100.0
148	Cu Cl. Conc.	9.57	25.8	3.52	89.3	7.5
	Cu Ro. Conc.	20.53	12.61	6.00	93.7	27.5
	Cu Flot. Tail.	79.47	0.22	4.09	6.3	72.5
	Head (Calc.)	100.00	2.76	4.47	100.0	100.0

Discussion - Continued

3.4.2. Effect of Levels of Lime and SO_2 Additions With and Without Presence of LS3 Depressant - Cont'd

Figure No. 12

Copper Grade-Recovery Curve - Effect of Level of CaO and SO_2 Additions



Discussion - Continued

3.4.3. Effect of Points of SO_2 and Lime Addition in the Presence of LS3 Depressant

Comparative tests were carried out with LS3 depressant in which the points of addition of lime and SO_2 were varied. The results for these tests are compared in Table No. 24 and Figure No. 13.

Table No. 24

Effect of Point of Lime and SO_2 Additions Using LS3 Depressant
(LS3 Additions 270 g/t)

Test	Reagent Additions, g/t		Product	Weight	Assays, %		% Distribution	
	Point of Addition							
No.	SO_2	CaO		%	Cu	Zn	Cu	Zn
142	1100 Aeration	800 Condition	Cu Cleaner Conc.	9.60	26.3	6.35	90.2	13.7
			Cu 1st Cl. Conc.	14.12	18.79	8.98	94.7	28.5
			Cu Comb. Tail.	85.88	0.16	3.72	5.3	71.5
			Head (Calc.)	100.00	2.80	4.46	100.0	100.0
156	900 20 % Grind 80 % Cond.+ Cleaners	400 Grind	Cu Cleaner Conc.	9.06	28.0	4.45	92.2	9.3
			Cu 1st Cl. Conc.	11.38	23.00	6.25	95.0	16.4
			Cu Comb. Tail.	88.62	0.15	4.07	5.0	83.6
			Head (Calc.)	100.00	2.75	4.32	100.0	100.0

In test No. 156, lime was added to the grind along with 20 % of the total SO_2 addition. The remaining 80 % of the SO_2 was added to the conditioning and cleaning steps.

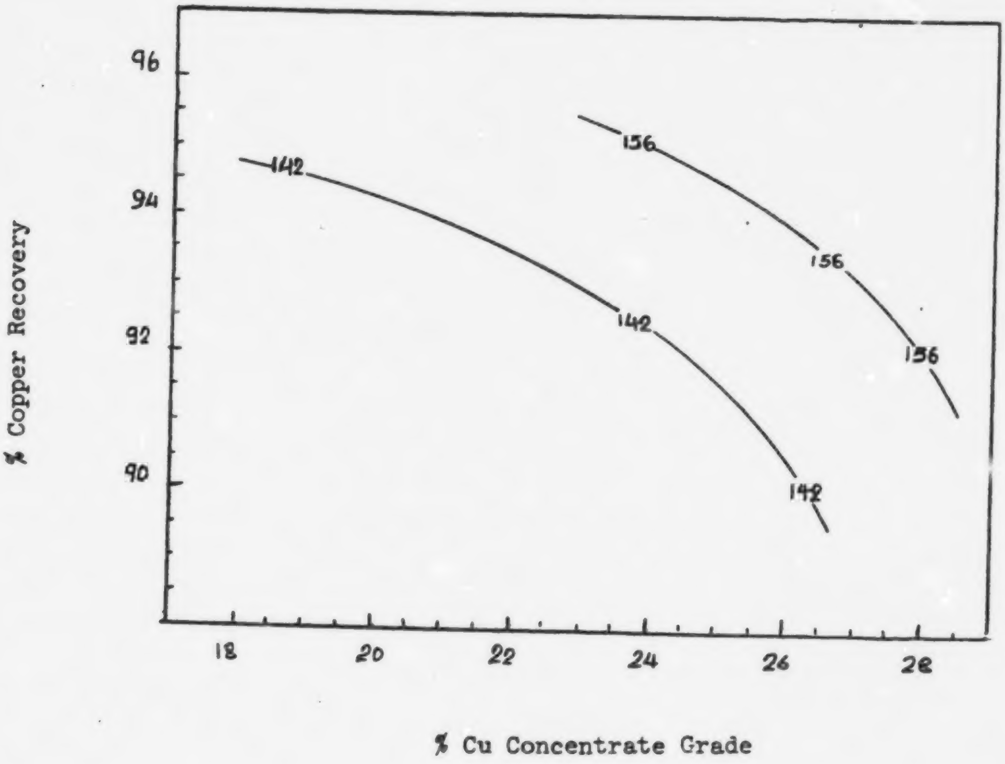
The addition of lime and part of the SO_2 to the grind in the presence of LS3 depressant resulted in significant improvements in copper-zinc selectivity (Table No. 24) and cleaning efficiency (Figure No. 13). Note that further reductions in the levels of SO_2 and lime consumption were possible with the changes in points of lime and SO_2 additions.

Discussion - Continued

3.4.3. Effect of Points of SO_2 and Lime Addition in the Presence of LS3 Depressant - Cont'd

Figure No. 13

Copper Grade vs. Recovery, Effect of Point of CaO and SO_2 Additions



Discussion - Continued

3.5. Complete Flotation Tests: Comparison of the Effect of Organic Depressant LS3

Two complete tests were performed to compare the effect of LS3 depressant on the copper and zinc metallurgical results. Comparison tests were conducted without depressant LS3 and with standard lime and SO_2 additions. The results of these tests are compared in Table No. 25.

Table No. 25

Effect of Organic Depressant LS3 - Final Test - Comparison of Results

Test No.	LS3 Added g/t	Product	Weight %	Assays, %		% Distribution		
				Cu	Zn	Cu	Zn	
							O'all	Circuit
155	150 Ro. + 60 Cl.	Cu 3rd Cl. Conc.	8.64	28.5	4.21	92.2	8.8	-
		Cu 1st Cl. Conc.	10.72	23.63	5.74	94.8	14.9	-
		Zn Cl. Conc.	6.00	0.76	54.50	1.7	79.1	92.9
		Zn Ro. Conc.	13.14	0.67	2[illegible].97	3.3	82.5	97.0
		Zn Flot. Tail.	76.14	0.067	0.14	1.9	2.6	3.0
		Head (Calc.)	100.00	2.67	4.13	100.0	100.0	100.0
149	0	Cu 3rd Cl. Conc.	9.98	25.0	5.16	90.9	11.5	-
		Cu 1st Cl. Conc.	12.34	20.74	6.25	93.2	17.2	-
		Zn Cl. Conc.	6.70	0.74	51.40	1.8	77.2	93.2
		Zn Ro. Conc.	11.08	0.85	32.02	3.4	79.5	96.0
		Zn Flot. Tail.	76.58	0.12	0.19	3.4	3.3	4.0
		Head (Calc.)	100.00	2.75	4.46	100.0	100.0	100.0

The net effects of organic LS3 depressant on copper and zinc flotation could be described as follows:

a) With the use of LS3 depressant, the lime and SO_2 requirements could be substantially reduced.

b) With additions of LS3 depressant, the copper and zinc metallurgical results were better than those obtained with standard lime and SO_2 additions.

Discussion - Continued

4. Evaluation of LS Depressants on Cyprus Anvil Lead-Zinc Ore

4.1. Description of Samples Used for Flotation Testwork

The lead-zinc ore used in this testwork came from the Faro 3 ore zone. The ore contained higher than average pyrrhotite. The pyrrhotite from this ore forms fine grained aggregates, with veinlets of finely disseminated galena and sphalerite. The head analysis of the laboratory sample was as follows:

Copper (Cu) =	0.13 %
Lead (Pb) =	5.25 %
Zinc (Zn) =	6.64 %
Iron (Fe) =	31.40 %
Sulphur (S) =	38.40 %
Gold (Au) =	0.09 g/t
Silver (Ag) =	52.6 g/t

4.2. Laboratory Test Procedure for Testing Lead-Zinc Ore

The laboratory procedure for testing the Cyprus Anvil lead-zinc ore is illustrated in Figures No. 14 (a,b). The actual concentrator flowsheet is shown in Figure No. 15. The concentrator flowsheet utilizes the production of a Pb-Zn-Fe bulk concentrate from the lead and zinc circuit cleaner tailings. The flowsheet allows the production of a high grade lead concentrate (over 65 % Pb) with lower recovery. The plant flowsheet was not used when testing various types of Cyprus Anvil ores.

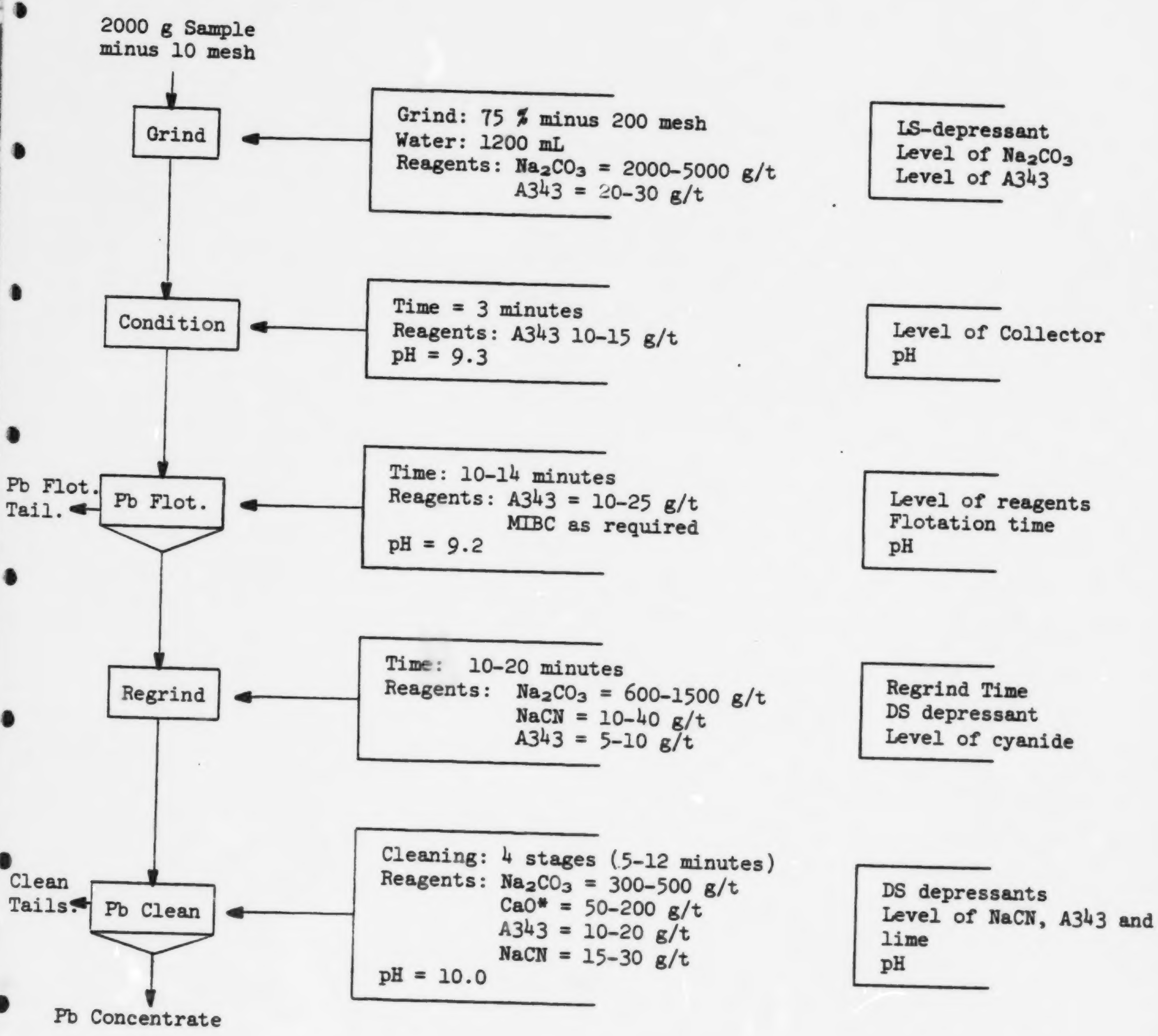
Discussion - Continued

4.2. Laboratory Test Procedure for Testing Lead-Zinc Ore - Cont'd

Figure No. 14

Schematic Outline of Laboratory Procedure for Testing Pb-Zn Cyprus Anvil Ore (Standard)

a) Pb Circuit


2000 g Sample
minus 10 mesh
Grind
Condition
Pb Flot.
Pb Flot. Tail.
Regrind
Pb Clean
Clean Tails.
Pb Concentrate

Grind: 75 % minus 200 mesh
Water: 1200 mL
Reagents: Na_2CO_3 = 2000-5000 g/t
A343 = 20-30 g/t

LS-depressant
Level of Na_2CO_3
Level of A343

Time = 3 minutes
Reagents: A343 10-15 g/t
pH = 9.3

Level of Collector
pH

Time: 10-14 minutes
Reagents: A343 = 10-25 g/t
MIBC as required
pH = 9.2

Level of reagents
Flotation time
pH

Time: 10-20 minutes
Reagents: Na_2CO_3 = 600-1500 g/t
NaCN = 10-40 g/t
A343 = 5-10 g/t

Regrind Time
DS depressant
Level of cyanide

Cleaning: 4 stages (5-12 minutes)
Reagents: Na_2CO_3 = 300-500 g/t
CaO* = 50-200 g/t
A343 = 10-20 g/t
NaCN = 15-30 g/t
pH = 10.0

DS depressants
Level of NaCN, A343 and lime
pH

*added to last two cleaners

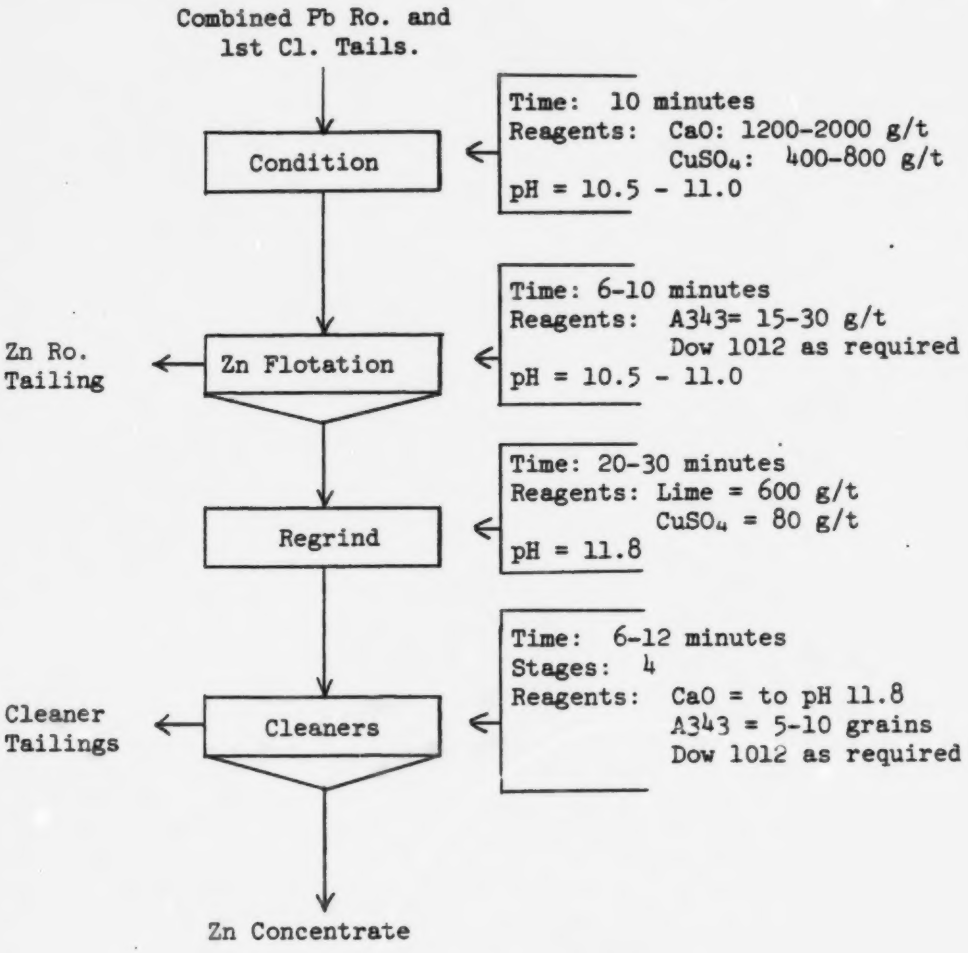
Discussion - Continued

4.2. Laboratory Test Procedure for Testing Lead-Zinc Ore - Cont'd

Figure No. 14 - Cont'd

Schematic Outline of Laboratory Procedure for Testing Pb-Zn Cyprus Anvil Ore (Standard)

b) Zinc Circuit

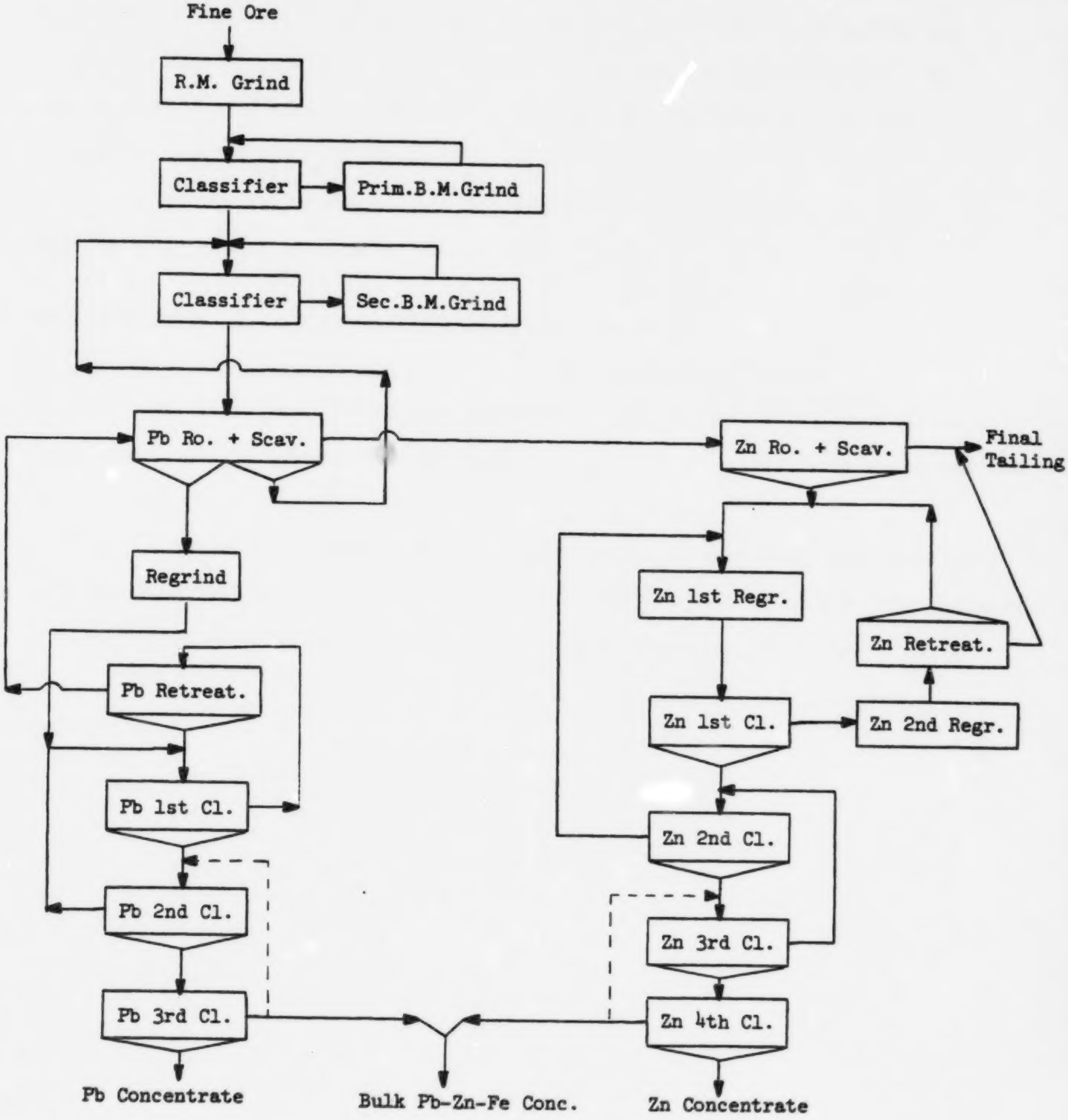

Combined Pb Ro. and 1st Cl. Tails.
Condition
Time: 10 minutes
Reagents: CaO: 1200-2000 g/t
CuSO$_4$: 400-800 g/t
pH = 10.5 - 11.0
Zn Ro. Tailing
Zn Flotation
Time: 6-10 minutes
Reagents: A343= 15-30 g/t
Dow 1012 as required
pH = 10.5 - 11.0
Regrind
Time: 20-30 minutes
Reagents: Lime = 600 g/t
CuSO$_4$ = 80 g/t
pH = 11.8
Cleaner Tailings
Cleaners
Time: 6-12 minutes
Stages: 4
Reagents: CaO = to pH 11.8
A343 = 5-10 grains
Dow 1012 as required
Zn Concentrate

Discussion - Continued

4.2. Laboratory Test Procedure for Testing Lead-Zinc Ore - Cont'd

Figure No. 15

Concentrator Flowsheet for Treatment of Cyprus Anvil Lead-Zinc Ore


Fine Ore
R.M. Grind
Classifier
Prim.B.M.Grind
Classifier
Sec.B.M.Grind
Pb Ro. + Scav.
Zn Ro. + Scav.
Final Tailing
Regrind
Pb Retreat.
Pb 1st Cl.
Pb 2nd Cl.
Pb 3rd Cl.
Zn 1st Regr.
Zn Retreat.
Zn 1st Cl.
Zn 2nd Regr.
Zn 2nd Cl.
Zn 3rd Cl.
Zn 4th Cl.
Pb Concentrate
Bulk Pb-Zn-Fe Conc.
Zn Concentrate

Discussion - Continued

4.3. Concentrator Metallurgical Results

The mill metallurgical results are largely dependant on the type of ore treated. The ores from Faro 3 zone and the Faro 2 zone with high pyrite and pyrrhotite content usually give low concentrate grades and low recoveries. The coarse-grained ores with lower pyrite content and no pyrrhotite produce high concentrate grades and high recoveries.

The laboratory sample used for evaluation of LS depressant was Faro 3 ore with high pyrite and pyrrhotite content.

4.4. Evaluation of LS Depressants on Lead-Zinc Ore

4.4.1. Preliminary Flotation Tests Using Standard Laboratory Procedure

Initially three tests were conducted to examine the flotation of lead and zinc under standard laboratory conditions. The results for these tests are summarized in Table No. 26.

Although minor changes in the reagent additions were made, both lead and zinc metallurgical results varied significantly from one test to another. It appeared that both lead and zinc flotation were sensitive to collector additions.

Discussion - Continued

4.4.1. Preliminary Flotation Tests Using Standard Laboratory Procedure - Cont'd

Table No. 26

Preliminary Flotation Tests Using Plant Conditions

Test No.	Product	Weight %	Assays, %		% Distribution	
			Pb	Zn	Pb	Zn
2	Lead Cl. Conc.	6.46	59.7	5.58	75.9	5.4
	Lead Ro. Conc.	19.62	24.2	7.99	93.3	23.6
	Zinc Cl. Conc.	5.68	0.38	54.1	0.2	46.3
	Zinc Ro. Conc.	17.23	0.66	28.6	2.2	74.3
	Zinc Flot. Tail.	63.15	0.36	0.22	4.5	2.1
	Head (Calc.)	100.00	5.08	6.64	100.0	100.0
5	Lead Cl. Conc.	6.25	64.5	5.55	79.4	5.3
	Lead 1st Cl. Conc.	10.27	44.7	8.86	90.5	13.9
	Zinc Cl. Conc.	7.05	0.62	49.2	0.9	52.6
	Zinc Ro. Conc.	31.75	1.03	27.4	2.9	57.1
	Zinc Flot. Tail.	75.98	0.45	2.52	6.6	29.0
	Head (Calc.)	100.00	5.08	6.59	100.0	100.0
6	Lead Cl. Conc.	8.76	51.3	6.94	87.4	9.0
	Lead 1st Cl. Conc.	12.86	36.9	7.78	92.2	14.9
	Zinc Cl. Conc.	8.73	0.39	53.3	0.7	69.1
	Zinc Ro. Conc.	17.87	0.80	29.0	2.8	76.9
	Zinc Flot. Tail.	69.27	0.37	0.79	5.0	8.2
	Head (Calc.)	100.00	5.15	6.73	100.0	100.0

Discussion - Continued

4.4.2. Lead Rougher Tests

4.4.2.1. Effect of Different LS Depressants on Lead Rougher Flotation Without Cyanide Addition

A series of six tests were conducted in which different LS depressants were tested. Depressants LS1, LS2, LS3 and LS6 were used in these tests. The condition and results of these tests are shown in Table No. 27.

Table No. 27

Effect of Different Organic Mixture on Lead Flotation Without Cyanide Additions

a) Conditions

Test No.	Reagent Addition, g/t				pH
	Na_2CO_3	LS-1	LS-2	LS-3	
12	2000	150	-	-	9.0
13	2000	75	-	-	9.1
14	2000	-	75	-	9.0
15	2000	-	-	75	9.1
17	2700	-	-	-	9.0
				LS-6	
38	2000	-	-	75	8.1

Discussion - Continued

4.4.2.1. Effect of Different LS Depressants on Lead Rougher Flotation Without Cyanide Addition - Cont'd

Table No. 27 - Cont'd

Effect of Different Organic Mixture on Lead Flotation Without Cyanide Additions

b) Results

Test No.	Product	Weight %	Assays, %		% Distribution	
			Pb	Zn	Pb	Zn
12	Lead Ro. Conc.	6.88	21.1	8.89	27.4	9.2
	Lead Ro. Tail.	93.12	4.12	6.46	72.6	90.7
	Head (Calc.)	100.00	5.29	6.63	100.0	100.0
13	Lead Ro. Conc.	5.77	17.0	9.05	18.7	7.8
	Lead Ro. Tail.	94.23	4.52	6.58	81.3	92.2
	Head (Calc.)	100.00	5.24	6.72	100.0	100.0
14	Lead Ro. Conc.	5.97	17.50	9.99	19.9	9.1
	Lead Ro. Tail.	94.03	4.47	6.35	80.1	90.9
	Head (Calc.)	100.00	5.25	6.56	100.0	100.0
15	Lead Ro. Conc.	7.45	19.70	9.08	27.9	10.1
	Lead Ro. Tail.	92.55	4.09	6.51	72.1	89.9
	Head (Calc.)	100.00	5.25	6.70	100.0	100.0
17	Lead Ro. Conc.	10.96	24.7	8.72	50.0	14.6
	Lead Ro. Tail.	89.04	3.03	6.28	50.0	85.4
	Head (Calc.)	100.00	5.41	6.55	100.0	100.0
38	Lead Ro. Conc.	11.85	24.10	8.53	54.0	15.5
	Lead Ro. Tail.	88.15	2.76	6.21	46.0	84.5
	Head (Calc.)	100.00	5.28	6.48	100.0	100.0

The results obtained showed that flotation of lead without cyanide was not possible. The lead recovery in the lead rougher concentrate ranged from 18.7 % to 54 %.

Discussion - Continued

4.4.2.2. Effect of Level of Cyanide Additions on Lead Flotation

This series of tests was designed to examine the effect of the level of cyanide addition on lead rougher flotation. The level of cyanide in these tests was varied from 0 g/t to 75 g/t. The conditioning and results for these tests are summarized in Table No. 28.

Table No. 28

Effect of Level of Cyanide Additions on Pb Rougher Flotation

Test No.	NaCN Added g/t	pH Rougher	Product	Weight %	Assays, %		% Distribution	
					Pb	Zn	Pb	Zn
16	75	9.1	Lead Ro. Conc.	20.96	24.3	7.60	94.0	24.4
			Lead Ro. Tail.	79.04	0.41	6.25	6.0	75.6
			Head (Calc.)	100.00	5.42	6.53	100.0	100.0
17	0	9.0	Lead Ro. Conc.	10.96	24.70	8.72	50.0	14.6
			Lead Ro. Tail.	89.04	3.03	6.28	50.0	85.4
			Head (Calc.)	100.00	5.41	6.55	100.0	100.0
42	50	8.8	Lead Ro. Conc.	21.02	23.5	7.49	94.0	23.7
			Lead Ro. Tail.	78.98	0.40	6.48	6.0	76.3
			Head (Calc.)	100.00	5.26	6.70	100.0	100.0
45	25	8.8	Lead Ro. Conc.	19.19	24.5	7.69	89.1	22.4
			Lead Ro. Tail.	80.81	0.71	6.30	10.9	77.6
			Head (Calc.)	100.00	5.27	6.57	100.0	100.0

The results obtained in these tests showed that the lead recovery in the rougher concentrate was a function of the level of cyanide added to the grinding stage. Without cyanide (Test No. 17), the lead recovery was only 50 % as compared to 94 % obtained with addition of 50 g/t NaCN. The increase in level of cyanide additions from 50 g/t to 75 g/t had no effect on lead recovery.

Discussion - Continued

4.4.2.3. Effect of LS3 Depressant Using Various Levels of Cyanide

In these tests the level of cyanide addition was varied with and without addition of LS3 depressant. The results for these tests are compared in Table No. 29.

Table No. 29

Effect of LS3 Depressant Using Various Levels of NaCN - Comparison of Results

Test No.	Depressant Added g/t		Product	Weight %	Assays, %		% Distribution	
	NaCN	LS-3			Pb	Zn	Pb	Zn
17	0	0	Pb Ro. Conc.	10.96	24.70	8.72	50.0	14.6
			Pb Ro. Tail.	89.04	3.03	6.28	50.0	85.4
			Head(Calc.)	100.00	5.41	6.55	100.0	100.0
38	0	75	Pb Ro. Conc.	11.85	24.1	8.99	54.0	11.4
			Pb Ro. Tail.	88.15	2.76	6.21	46.0	84.5
			Head (Calc.)	100.00	5.28	6.49	100.0	100.0
45	25	0	Pb Ro. Conc.	19.19	24.5	7.69	89.1	22.4
			Pb Ro. Tail.	80.81	0.71	6.30	10.9	77.6
			Head (Calc.)	100.00	5.27	6.57	100.0	100.0
44	25	75	Pb Ro. Conc.	18.00	25.5	7.74	87.9	18.1
			Pb Ro. Tail.	82.00	0.77	6.42	12.1	79.1
			Head (Calc.)	100.00	5.22	6.66	100.0	100.0
42	50	0	Pb Ro. Conc.	21.02	23.5	7.49	94.0	23.7
			Pb Ro. Tail.	78.98	0.40	6.48	6.0	76.3
			Head (Calc.)	100.00	5.26	6.70	100.0	100.0
43	50	75	Pb Ro. Conc.	18.90	26.40	8.15	93.0	23.7
			Pb Ro. Tail.	81.10	0.42	6.09	7.0	76.3
			Head (Calc.)	100.00	5.36	6.48	100.0	100.0
16	75	0	Pb Ro. Conc.	20.96	24.3	7.60	94.0	24.4
			Pb Ro. Tail.	79.04	0.41	6.25	6.0	75.6
			Head (Calc.)	100.00	5.42	6.53	100.0	100.0
37	75	75	Pb Ro. Conc.	24.33	20.4	7.19	93.2	26.3
			Pb Ro. Tail.	75.67	0.45	6.47	6.8	73.7
			Head (Calc.)	100.00	5.32	6.64	100.0	100.0

The results from these tests showed that a slight improvement in the selectivity between lead and pyrite was obtained with addition of LS3 depressant in the presence of 50 g/t NaCN.

Discussion - Continued

4.4.2.4. Effect of Different LS Depressants on Pb Flotation Using 50 g/t Cyanide

A series of four tests was conducted to examine the effect of various LS depressants on lead rougher flotation. Depressants LS3, LS7 and LS8 were included in these tests. These results are compared with the results of test No. 42 with no LS depressant in Table No. 30.

Table No. 30

Effect of LS3, LS7 and LS8 on Pb Flotation Using 50 g/t NaCN - Comparison of Results

Test No.	Organic Depressant Used	Product	Weight %	Assays, %		% Distribution	
				Pb	Zn	Pb	Zn
42	None	Pb Ro. Conc. 1+2	18.10	26.8	7.49	92.3	20.2
		Pb Ro. Conc. 1-3	21.02	23.5	7.56	94.0	23.7
		Pb Rougher Tail.	78.98	0.40	6.48	6.0	76.3
		Head (Calc.)	100.00	5.26	6.70	100.0	100.0
43	LS-3 75 g/t	Pb Ro. Conc. 1+2	16.13	30.3	8.12	91.2	20.2
		Pb Ro. Conc. 1-3	18.90	26.4	8.15	93.0	23.7
		Pb Rougher Tail.	81.10	0.46	6.09	7.0	76.3
		Head (Calc.)	100.00	5.36	6.48	100.0	100.0
48	LS-7 75 g/t	Pb Ro. Conc. 1+2	14.56	33.0	7.89	89.0	17.3
		Pb Ro. Conc. 1-3	17.37	28.2	8.08	91.5	21.1
		Pb Rougher Tail.	82.63	0.55	6.32	8.5	78.9
		Head (Calc.)	100.00	5.36	6.63	100.0	100.0
49	LS-8 75 g/t	Pb Ro. Conc. 1+2	18.54	26.3	7.71	92.1	21.4
		Pb Ro. Conc. 1-3	20.86	23.7	7.85	93.6	24.5
		Pb Rougher Tail.	79.14	0.43	6.34	6.4	75.5
		Head (Calc.)	100.00	5.29	6.66	100.0	100.0

The best lead-pyrite selectivity in the lead rougher was obtained in test No. 48 with LS7 depressant, but the lead recovery was lower than that obtained in test No. 42 without LS depressant addition.

4.4.3. Lead Cleaning Tests

4.4.3.1. Effect of Level of NaCN in the Lead Cleaning With and Without LS7 Additions

Nine tests were performed to examine the effect of level of cyanide additions on lead cleaning, with and without LS7 depressant additions. The results and conditions for these tests are summarized in Table No. 31.

The results obtained indicated the following:

1. In the absence of cyanide and LS7 additions to the lead cleaners (Test No. 68), the lead cleaner recovery was reduced as compared to test No. 52 in which 12.5 g/t NaCN was added to the cleaning. Increasing the level of cyanide addition from 12 g/t to 50 g/t had no significant effect on lead cleaning.
2. With the use of depressant LS7, the presence of cyanide to the lead cleaning had no significant effect on lead cleaner grade and recovery (Test No. 65 and 67).

4.4.3.1. Effect of Level of NaCN in the Lead Cleaning with and Without LS7 Additions - Cont'd

Table No. 31

Effect of Level of Cyanide Additions in the Lead Cleaning - With and Without LS7 Additions

Test No.	Reagent Added g/t		Product	Weight %	Assays, %		% Distribution	
	NaCN	LS-7			Pb	Zn	Pb	Zn
50	50*	0*	Pb Cl. Conc.	7.73	56.0	6.13	82.6	7.2
			Pb Ro. Conc.	20.75	23.8	7.86	94.1	24.7
	50**	0**	Pb Flot. Tail.	79.25	0.39	6.30	5.9	75.3
			Head (Calc.)	100.00	5.24	6.62	100.0	100.0
51	50	0	Pb Cl. Conc.	7.60	53.6	5.57	79.7	6.3
			Pb Ro. Conc.	20.70	22.9	7.56	92.9	23.3
	25	0	Pb Flot. Tail.	79.30	0.46	6.46	7.1	76.7
			Head (Calc.)	100.00	5.11	6.69	100.0	100.0
52	50	0	Pb Cl. Conc.	7.63	54.8	6.49	82.5	7.3
			Pb Ro. Conc.	20.47	23.2	7.60	93.7	23.0
	12.5	0	Pb Flot. Tail.	79.53	0.40	6.56	6.3	77.0
			Head (Calc.)	100.00	5.07	6.77	100.0	100.0
68	50	0	Pb Cl. Conc.	7.35	53.50	5.97	78.5	6.6
			Pb Ro. Conc.	19.91	23.64	7.99	94.1	23.8
	0	0	Pb Flot. Tail.	80.09	0.37	6.34	5.9	76.2
			Head (Calc.)	100.00	5.00	6.67	100.0	100.0
65	50*	75	Pb Cl. Conc.	7.10	57.1	2.36	80.9	2.7
			Pb Ro. Conc.	18.11	25.3	6.87	91.7	19.9
	25	30	Pb Flot. Tail.	81.89	0.51	6.11	8.3	80.0
			Head (Calc.)	100.00	5.01	6.25	100.0	100.0
66	50	75	Pb Cl. Conc.	6.70	59.2	5.42	79.2	5.6
			Pb Ro. Conc.	16.90	27.1	8.00	91.4	20.8
	12	30	Pb Flot. Tail.	83.10	0.52	6.16	8.6	79.2
			Head (Calc.)	100.00	5.00	6.47	100.0	100.0
67	50	75	Pb Cl. Conc.	7.17	56.4	6.27	79.1	6.9
			Pb Ro. Conc.	17.93	26.0	8.11	91.2	22.3
	0	30	Pb Flot. Tail.	82.07	0.55	6.17	8.8	77.7
			Head (Calc.)	100.00	5.11	6.52	100.0	100.0
69	25	75	Pb Cl. Conc.	7.59	55.0	6.93	80.5	8.0
			Pb Ro. Conc.	21.99	21.82	7.25	92.4	24.2
	12	30	Pb Flot. Tail.	78.01	0.50	6.37	7.6	75.8
			Head (Calc.)	100.00	6.19	6.56	100.0	100.0
84	25	0	Pb Cl. Conc.	8.88	50.1	6.51	86.8	8.7
			Pb Ro. Conc.	21.95	21.67	7.56	92.7	24.9
	12	0	Pb Flot. Tail	78.05	0.47	6.34	7.3	75.1
			Head (Calc.)	100.00	5.12	6.61	100.0	100.0

*Rougher, **Cleaner

Discussion - Continued

4.4.3.2. Effect of Level of Depressant LS7 Additions

Three tests were performed to examine the effect of level of LS7 addition to the lead rougher. In these tests the LS7 addition to the lead cleaners was kept constant. The results and conditions for these tests are summarized in Table No. 32.

Table No. 32

Effect of Levels of LS-7 Additions on Lead Rougher and Cleaning

Test	LS-7 Added g/t		Product	Weight	Assays, %		% Distribution	
No.	Ro.	Cl.		%	Pb	Zn	Pb	Zn
87	150	50	Pb Cl. Conc.	6.45	57.80	7.56	73.2	7.2
			Pb Ro. Conc.	18.23	25.14	7.78	90.0	20.8
			Pb Flot. Tail.	81.77	0.62	6.58	10.0	79.2
			Head (Calc.)	100.00	5.08	6.70	100.0	100.0
66	75	50	Pb Cl. Conc.	6.79	59.2	5.42	79.2	5.6
			Pb Ro. Conc.	16.90	27.1	8.00	91.4	20.8
			Pb Flot. Tail.	83.10	0.52	6.16	8.6	79.2
			Head (Calc.)	100.00	5.00	6.47	100.0	100.0
88	40	50	Pb Cl. Conc.	7.28	55.5	7.05	79.4	7.7
			Pb Ro. Conc.	21.85	21.86	7.51	93.7	24.7
			Pb Flot. Tail.	78.15	0.40	6.40	6.3	75.3
			Head (Calc.)	100.00	5.09	6.64	100.0	100.0

The results obtained indicated that selectivity between lead and pyrite improved at higher levels of LS7 addition (75 - 150 g/t), but the lead rougher recovery was reduced.

Discussion - Continued

4.4.3.3. Effect of Different LS3 Composition on Lead Flotation

In the series of tests (90 to 93) different compositions of LS3 mixture were examined. The conditions and results for these tests are summarized in Table No. 33.

Table No. 33

Evaluation of Different Composition of LS3 Depressant on Lead Flotation

Test No.	Depressant Added	Product	Weight %	Assays, %		% Distribution	
				Pb	Zn	Pb	Zn
90	LS3	Pb Cl. Conc.	8.18	53.2	8.22	86.2	10.3
		Pb Ro. Conc.	20.93	22.61	6.86	93.6	23.0
		Pb Flot. Tail.	79.07	0.40	6.45	6.4	77.0
		Head (Calc.)	100.00	5.05	6.53	100.0	100.0
91	LS3A	Pb Cl. Conc.	7.34	57.18	5.19	83.5	5.8
		Pb Ro. Conc.	19.97	23.55	7.79	93.6	23.7
		Pb Flot. Tail.	80.03	0.40	6.25	6.4	76.3
		Head (Calc.)	100.00	5.02	6.55	100.0	100.0
92	LS3B	Pb Cl. Conc.	7.81	55.86	5.46	86.8	6.7
		Pb Ro. Conc.	20.68	22.75	7.70	93.6	23.5
		Pb Flot. Tail.	79.32	0.40	6.52	6.4	76.5
		Head (Calc.)	100.00	5.02	7.70	100.0	100.0
93	LS3C	Pb Cl. Conc.	7.14	58.7	5.19	83.0	5.5
		Pb Ro. Conc.	20.52	23.07	7.52	93.5	23.0
		Pb Flot. Tail.	79.48	0.40	6.48	6.5	77.0
		Head (Calc.)	100.00	5.05	6.69	100.0	100.0

The variation in LS3 composition had no significant effect on lead-pyrite selectivity.

Discussion - Continued

4.4.4. Preliminary Full-Scale Flotation Tests - Effect of LS3 Depressant on Lead-Zinc Flotation

Initially three preliminary tests were performed to examine the effect of LS3 depressant on lead and zinc metallurgical results.

The conditions and results for these tests are summarized in Table No. 34

Table No. 34

Preliminary Full Scale Tests to Examine the Effect of LS3B Depressant on Lead and Zinc Flotation

Test	Reagent Added g/t		Product	Weight	Assays, %		% Distribution	
No.	NaCN	LS3B		%	Pb	Zn	Pb	Zn
98	50	-	Pb 4th Cl. Conc.	8.77	51.0	6.82	88.0	9.1
			Pb 1st Cl. Conc.	14.43	32.74	7.27	92.9	15.9
			Zn Cl. Conc.	12.05	0.55	42.8	1.3	78.2
			Zn Ro. Conc.	42.04	0.43	12.84	3.6	81.8
			Zn Flot. Tail.	43.53	0.40	0.33	3.5	2.3
			Head (Calc.)	100.00	5.08	6.59	100.0	100.0
101	50	40	Pb 4th Cl. Conc.	7.70	55.6	5.52	85.4	6.4
			Pb 1st Cl. Conc.	11.52	39.41	7.09	90.6	12.3
			Zn Cl. Conc.	11.44	0.66	47.4	1.5	80.8
			Zn Ro. Conc.	55.84	0.50	10.17	5.5	84.6
			Zn Flot. Tail.	32.64	0.60	0.65	3.9	3.1
			Head (Calc.)	100.00	5.01	6.71	100.0	100.0
102	50	-	Pb 4th Cl. Conc.	8.22	52.0	5.96	84.6	7.2
			Pb 1st Cl. Conc.	15.01	31.1	6.91	92.4	15.3
			Zn Cl. Conc.	10.95	0.57	48.1	1.2	77.9
			Zn Ro. Conc.	64.44	0.38	8.78	4.9	83.6
			Zn Flot. Tail.	20.55	0.67	0.37	2.7	1.1
			Head (Calc.)	100.00	5.05	6.77	100.0	100.0

In general, with additions of LS3 depressant, the selectivity between lead and pyrite minerals improved. In all tests the zinc cleaner concentrate grade was below 50 % Zn.

4.4.5. Final Full Scale Flotation Tests - Effect of LS3 Depressant

A series of four full scale tests was conducted in which the effect of LS3 depressant was compared with cyanide addition. The results for these tests are shown in Table No. 35.

The results from these tests showed the following:

1. With addition of LS3 depressant, an improvement in the lead concentrate grade was obtained.
2. When using LS3 depressant, the cyanide consumption can be reduced by 50 %. Complete replacement of cyanide by organic depressant was not possible since lead did not float without cyanide.
3. The addition of LS3 depressant to the lead circuit had no significant effect on subsequent zinc flotation.

Discussion - Continued

4.4.5. Final Full Scale Flotation Tests - Effect of LS3 Depressant - Cont'd

Table No. 35

Final Full Scale Tests to Examine the Effect of Organic Depressant on Lead an and Zinc Flotation

Test No.	Reagent Added g/t		Product	Weight %	Assays, %		% Distribution	
	NaCN	LS38			Pb	Zn	Pb	Zn
103	25	40	Pb 4th Cl. Conc.	7.45	58.4	5.13	84.9	5.6
			Pb 1st Cl. Conc.	12.73	37.19	7.17	92.3	13.4
			Zn Cl. Conc.	10.62	0.49	50.70	1.0	79.0
			Zn Ro. Conc.	27.08	0.66	21.16	3.5	84.1
			Zn Flot. Tail.	60.19	0.35	0.28	4.2	2.5
			Head (Calc.)	100.00	5.12	6.81	100.0	100.0
104	25	40	Pb 4th Cl. Conc.	6.76	60.80	4.62	80.8	4.7
			Pb 1st Cl. Conc.	12.03	38.85	6.83	92.0	12.3
			Zn Cl. Conc.	10.15	0.40	50.00	0.8	76.0
			Zn Ro. Conc.	23.62	0.82	24.16	3.9	85.4
			Zn Flot. Tail.	64.35	0.34	0.25	4.1	2.3
			Head (Calc.)	100.00	5.09	6.69	100.0	100.0
106	50	0	Pb 4th Cl. Conc.	7.88	55.6	5.19	84.1	6.0
			Pb 1st Cl. Conc.	14.03	34.22	6.76	92.1	14.0
			Zn Cl. Conc.	10.90	0.55	48.50	1.0	78.0
			Zn Ro. Conc.	20.31	0.80	28.00	3.1	83.9
			Zn Flot. Tail.	65.66	0.38	0.22	4.8	2.1
			Head (Calc.)	100.00	5.21	6.78	100.0	100.0
107	50	0	Pb 4th Cl. Conc.	7.43	57.40	4.95	83.3	5.5
			Pb 1st Cl. Conc.	13.12	35.80	6.79	91.7	13.3
			Zn Cl. Conc.	10.12	0.42	51.40	0.9	77.4
			Zn Ro. Conc.	19.00	0.83	29.46	3.1	83.3
			Zn Flot. Tail.	67.88	0.39	0.34	5.2	3.4
			Head (Calc.)	100.00	5.12	6.72	100.0	100.0

Discussion - Continued

5. Evaluation of LS Depressants on Copper-Lead-Zinc Ore From New Brunswick

5.1. Description of Samples Used for Flotation Testwork

The ore used in this testwork was fairly typical of the New Brunswick ore presently treated in the concentrator. Testwork was conducted on two ore samples received during October 1982 and May 1983, the head analyses of these samples were as follows:

	Sample 4	Sample 4A
Copper (Cu)	0.31 %	0.20 %
Lead (Pb)	3.32 %	3.85 %
Zinc (Zn)	8.55 %	9.39 %
Iron (Fe)	27.40 %	-
Sulphur (S)	32.00 %	-
Gold (Au)	0.65 g/t	-
Silver (Ag)	99.60 g/t	

The second sample was lower in copper and higher in lead and zinc. Both samples were rod mill feed at 25 mm nominal size.

5.2. Laboratory Procedure for Testing Copper-Lead-Zinc New Brunswick Ore

The laboratory procedure for testing of the New Brunswick ore is described in Figure No. 16. Most of the tests performed on this ore were copper-lead rougher and cleaning tests. Complete tests using the concentrator flowsheet (Figure No. 17 a,b) were not carried out. Only several Cu-Pb separation and Pb upgrading tests were performed.

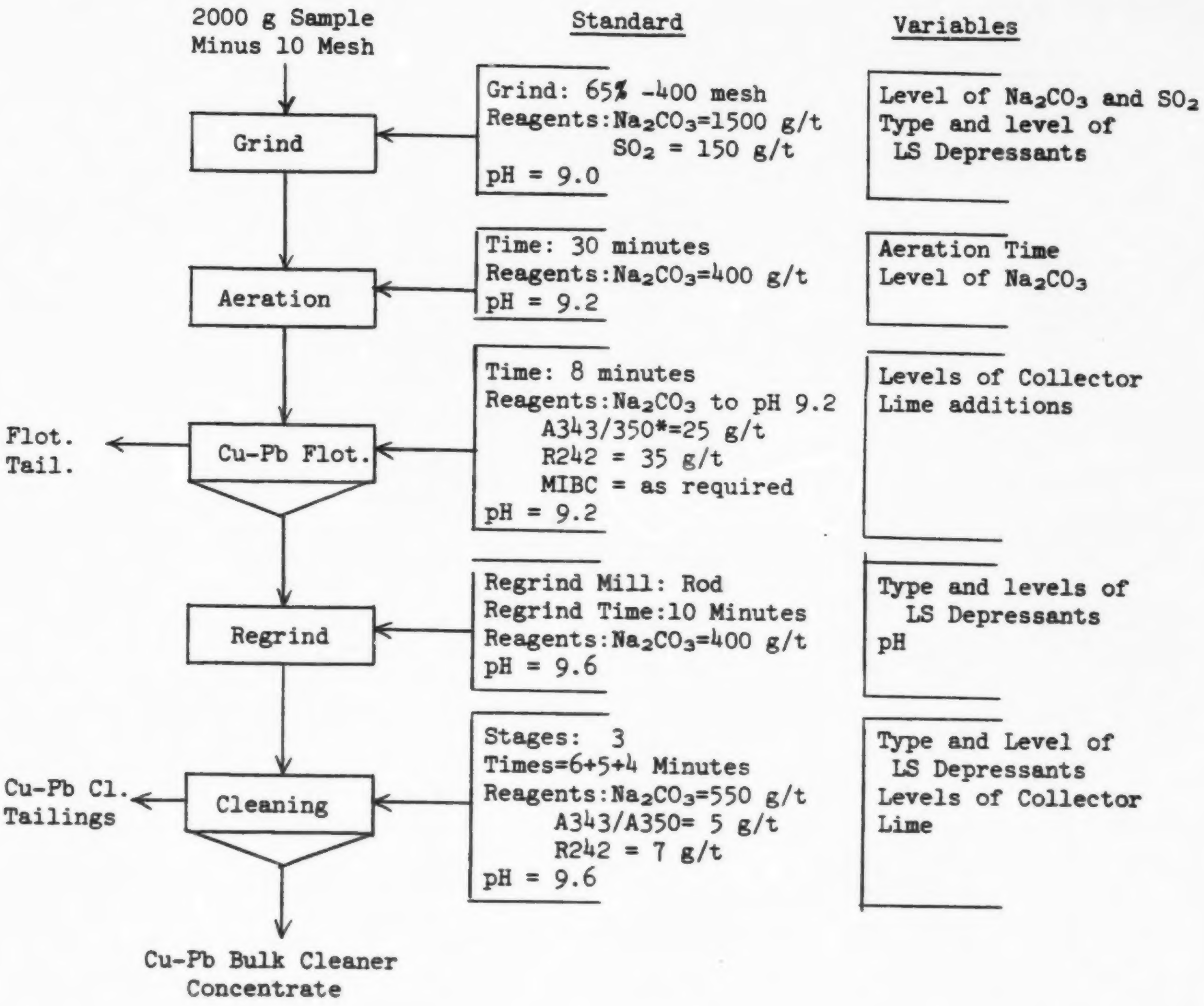
Discussion - Continued

5.2. Laboratory Procedure for Testing Copper-Lead-Zinc New Brunswick Ore - Cont'd

Figure No. 16

Schematic Outline of Laboratory Procedure for Testing of Cu-Pb-Zn New Brunswick Ore

Cu-Pb Circuit


2000 g Sample
Minus 10 Mesh
Standard
Variables
Grind
Grind: 65% -400 mesh
Reagents: Na_2CO_3=1500 g/t
SO_2 = 150 g/t
pH = 9.0
Level of Na_2CO_3 and SO_2
Type and level of LS Depressants
Aeration
Time: 30 minutes
Reagents: Na_2CO_3=400 g/t
pH = 9.2
Aeration Time
Level of Na_2CO_3
Flot. Tail.
Cu-Pb Flot.
Time: 8 minutes
Reagents: Na_2CO_3 to pH 9.2
A343/350*=25 g/t
R242 = 35 g/t
MIBC = as required
pH = 9.2
Levels of Collector
Lime additions
Regrind
Regrind Mill: Rod
Regrind Time: 10 Minutes
Reagents: Na_2CO_3=400 g/t
pH = 9.6
Type and levels of LS Depressants
pH
Cu-Pb Cl. Tailings
Cleaning
Stages: 3
Times=6+5+4 Minutes
Reagents: Na_2CO_3=550 g/t
A343/A350= 5 g/t
R242 = 7 g/t
pH = 9.6
Type and Level of LS Depressants
Levels of Collector
Lime
Cu-Pb Bulk Cleaner
Concentrate

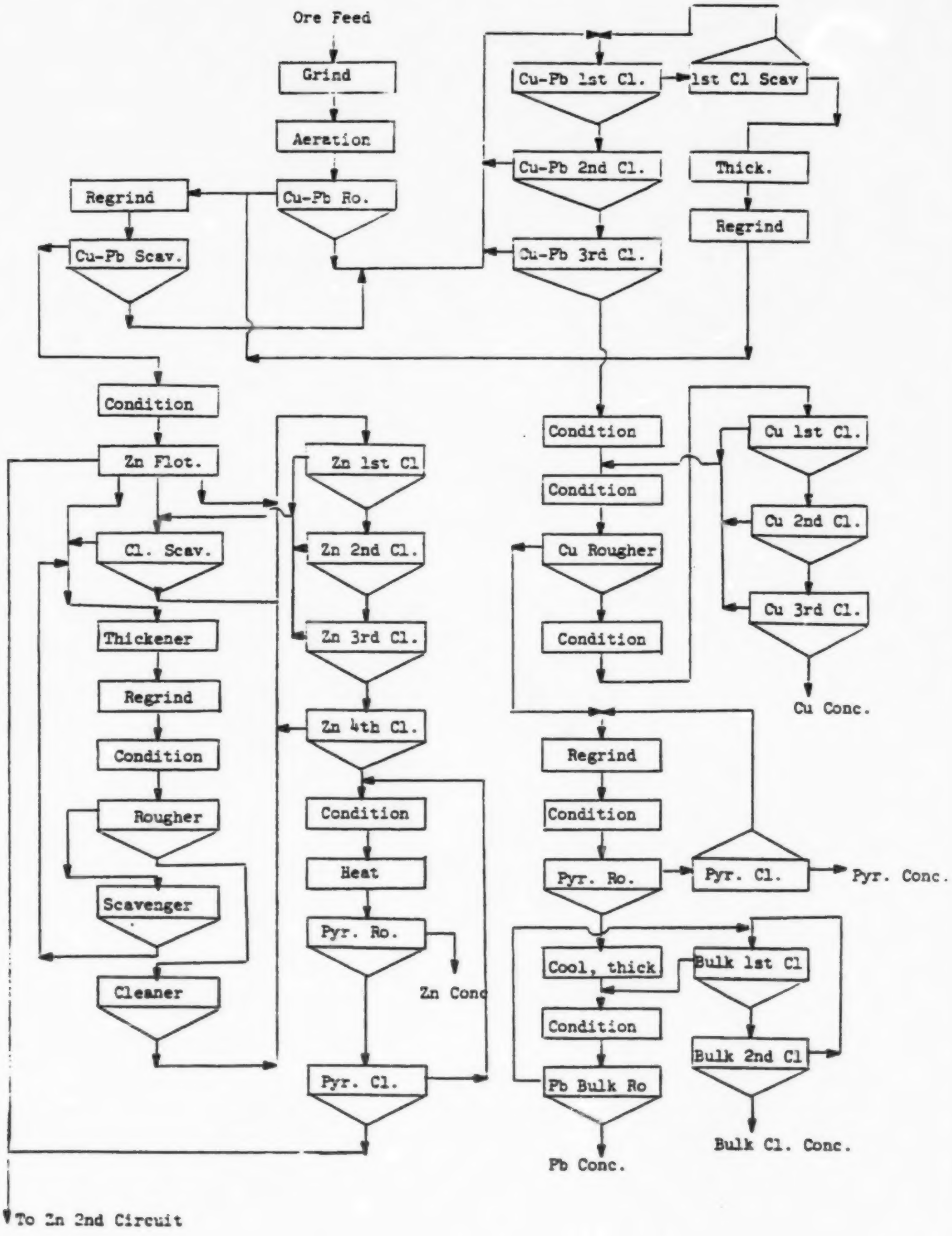
* A343/A350 = 4:1 Ratio

Discussion - Continued

5.2. Laboratory Procedure for Testing Copper-Lead-Zinc New Brunswick Ore - Cont'd

Figure No. 17 - Concentrator Flowsheet

a) Cu-Pb-Zn

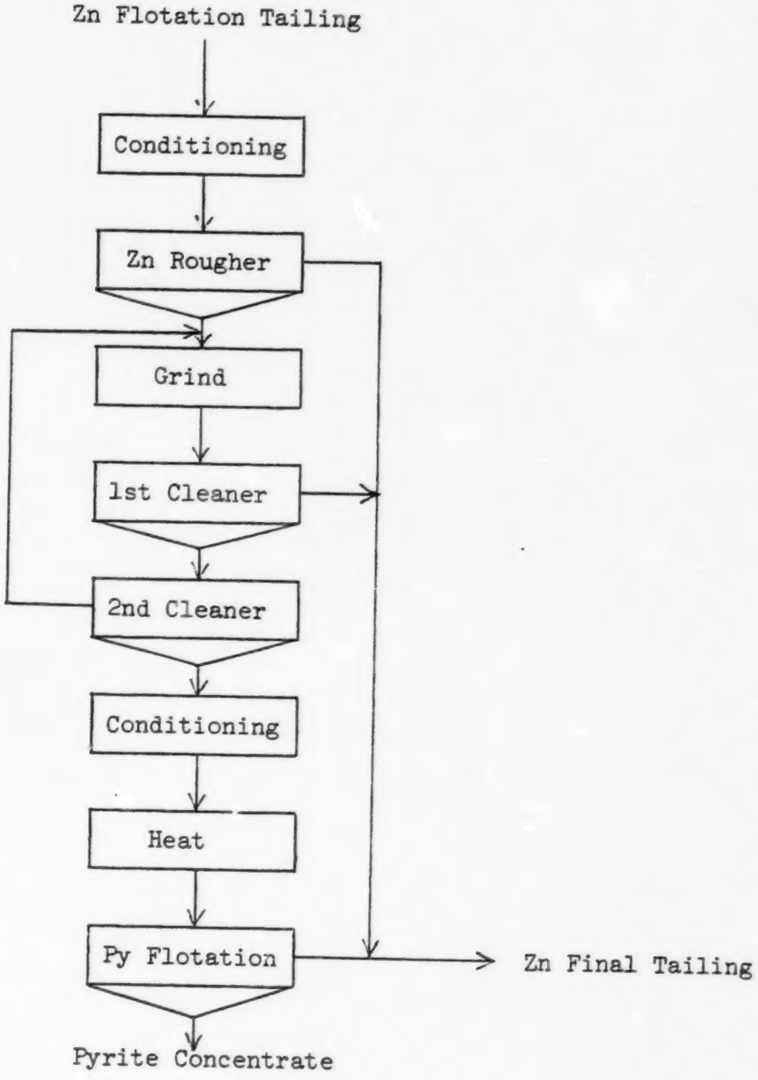

Ore Feed
Grind
Aeration
Cu-Pb Ro.
Regrind
Cu-Pb Scav.
Cu-Pb 1st Cl.
1st Cl Scav
Cu-Pb 2nd Cl.
Thick.
Cu-Pb 3rd Cl.
Regrind
Condition
Zn Flot.
Cl. Scav.
Thickener
Regrind
Condition
Rougher
Scavenger
Cleaner
Zn 1st Cl
Zn 2nd Cl.
Zn 3rd Cl.
Zn 4th Cl.
Condition
Heat
Pyr. Ro.
Zn Conc
Pyr. Cl.
Condition
Condition
Cu Rougher
Condition
Cu 1st Cl.
Cu 2nd Cl.
Cu 3rd Cl.
Cu Conc.
Regrind
Condition
Pyr. Ro.
Pyr. Cl.
Pyr. Conc.
Cool, thick
Condition
Pb Bulk Ro
Pb Conc.
Bulk 1st Cl
Bulk 2nd Cl
Bulk Cl. Conc.
To Zn 2nd Circuit

Discussion - Continued

5.2. Laboratory Procedure for Testing Copper-Lead-Zinc New Brunswick Ore - Cont'd

Figure No. 17 - Concentrator Flowsheet - Cont'd

b) Zn Secondary Circuit


Zn Flotation Tailing
Conditioning
Zn Rougher
Grind
1st Cleaner
2nd Cleaner
Conditioning
Heat
Py Flotation
Zn Final Tailing
Pyrite Concentrate

Discussion - Continued

5.3. Plant Metallurgical Results: Copper-Lead Circuit Only

Plant metallurgical results obtained on the copper-lead bulk circuit at the New Brunswick Concentrator are shown in Table No. 36.

Table No. 36

Copper-Lead Bulk Flotation Metallurgy

Product	Assays, %			% Distribution		
	Cu	Pb	Zn	Cu	Pb	Zn
Feed	0.25	3.76	9.20	100.0	100.0	100.0
Cu-Pb Bulk Cl. Conc.	1.50	30.00	12.00	52.6	70.0	11.5
Cu-Pb Bulk Cl. Tail.	0.13	1.23	8.92	47.4	30.0	88.5

5.4. Laboratory Testwork - Evaluation of LS Depressants

Most of the tests were performed on copper-lead bulk rougher and cleaning. Only preliminary tests were carried out on copper-lead separation and lead upgrading. In this testwork attempts were made to establish the effectiveness of LS depressants in the Cu-Pb rougher and cleaning.

Discussion - Continued

5.4.1. Preliminary Flotation Tests - Effect of SO_2 Additions

Initially, a series of three Cu-Pb rougher and cleaning tests were performed to evaluate the effect of level of SO_2 additions on Cu-Pb rougher and cleaning. The conditions and results for these tests are summarized in Table No. 37.

Table No. 37

Preliminary Flotation Tests - Effect of Level of SO_2 Additions

Test No.	SO_2 Added g/t	Product	Weight %	Assays, %			% Distribution		
				Cu	Pb	Zn	Cu	Pb	Zn
8	150	Cu-Pb Ro. Conc. 1	7.20	2.82	14.1	6.85	59.7	30.5	5.9
		Cu-Pb Ro. Conc. 1+2	15.11	1.70	15.3	8.60	75.5	69.4	15.6
		Cu-Pb Ro. Conc. 1-4	27.84	1.08	10.0	9.37	88.3	83.8	31.3
		Cu-Pb Ro. Tailing	72.16	0.055	0.75	7.95	11.7	16.2	68.7
		Head (Calc.)	100.00	0.34	3.33	8.35	100.0	100.0	100.0
9	300	Cu-Pb Ro. Conc. 1	6.38	3.18	14.6	6.77	59.6	27.7	5.1
		Cu-Pb Ro. Conc. 1+2	16.42	1.60	14.60	8.62	77.3	71.3	16.8
		Cu-Pb Ro. Conc. 1-4	27.74	1.09	10.10	9.28	88.7	83.6	30.6
		Cu-Pb Ro. Tailing	72.26	0.053	0.76	8.12	11.3	16.4	69.4
		Head (Calc.)	100.00	0.34	3.36	8.44	100.0	100.0	100.0
10	600	Cu-Pb Ro. Conc. 1	6.98	2.93	20.1	6.67	60.0	41.6	5.5
		Cu-Pb Ro. Conc. 1+2	17.35	1.54	14.3	9.04	79.2	74.5	18.7
		Cu-Pb Ro. Conc. 1-4	26.01	1.17	10.7	9.40	88.9	82.9	28.9
		Cu-Pb Ro. Tail.	73.99	0.051	0.78	8.14	11.1	17.1	71.1
		Head (Calc.)	100.00	0.34	3.37	8.47	100.0	100.0	100.0

In all tests the overall Cu-Pb grades and recoveries were similar, regardless of the level of SO_2 added. The higher level of SO_2 additions, however, improved initial rate of copper and lead flotation.

Discussion - Continued

5.4.2. Effect of Different LS Depressant Mixtures on Copper-Lead Bulk Rougher and Cleaning

In test No. 9 and Tests No. 22 to 24 the effect of depressants LS1, LS2 and LS3 were examined. The conditions and results for these tests are summarized in Table No. 38 (a,b).

Table No. 38

Evaluation of Different Organic Depressant Mixtures

a) Conditions

Test No.	Reagent Additions, g/t					Aeration Time Minutes	pH
	Na_2CO_3	SO_2	LS-1	LS-2	LS-3		
9	2950	300	-	-	-	30	9.2-9.6
22	3700	300	150	-	-	30	9.2-9.6
23	3700	300	-	150	-	30	9.2-9.6
24	3700	300	-	-	150	30	9.2-9.6

Discussion - Continued

5.4.2. Effect of Different LS Depressant Mixtures on Copper-Lead Bulk Rougher and Cleaning - Cont'd

Table No. 38 - Cont'd

Evaluation of Different Organic Depressant Mixtures

b) Results

Test No.	Product	Weight %	Assays, %			% Distribution		
			Cu	Pb	Zn	Cu	Pb	Zn
9	Cu-Pb Ro. Conc. 1	6.38	3.18	14.6	6.77	59.6	27.7	5.1
	Cu-Pb Ro. Conc. 1+2	16.42	1.60	14.6	8.62	77.3	71.3	16.8
	Cu-Pb Ro. Conc. 1-3	27.74	1.09	10.1	9.28	88.7	83.6	30.6
	Cu-Pb Flot. Tail.	72.26	0.053	0.76	8.12	11.3	16.6	69.4
	Head (Calc.)	100.00	0.34	3.36	8.44	100.0	100.0	100.0
22	Cu-Pb Ro. Conc. 1	11.54	2.15	16.4	7.97	72.9	56.6	10.7
	Cu-Pb Ro. Conc. 1+2	20.90	1.36	12.1	8.60	83.4	75.4	23.4
	Cu-Pb Ro. Conc. 1-3	31.83	0.96	8.78	9.70	90.0	83.5	36.0
	Cu-Pb Flot. Tail.	68.17	0.05	0.81	8.03	10.0	16.5	64.0
	Head (Calc.)	100.00	0.34	3.35	8.56	100.0	100.0	100.0
23	Cu-Pb Ro. Conc. 1	11.68	2.13	17.0	8.08	72.1	59.3	11.0
	Cu-Pb Ro. Conc. 1+2	21.19	1.35	12.0	9.30	83.1	75.7	29.9
	Cu-Pb Ro. Conc. 1-3	34.83	0.90	8.12	9.28	90.6	84.5	37.5
	Cu-Pb Flot. Tail.	65.17	0.05	0.80	8.24	9.4	15.5	62.5
	Head (Calc.)	100.00	0.35	3.35	8.60	100.0	100.0	100.0
24	Cu-Pb Ro. Conc. 1	11.52	2.17	17.5	7.81	71.6	60.0	10.5
	Cu-Pb Ro. Conc. 1+2	21.72	1.34	12.0	9.35	83.3	77.8	23.7
	Cu-Pb Ro. Conc. 1-3	33.54	0.93	8.47	9.17	89.3	84.7	35.8
	Cu-Pb Flot. Tail.	66.46	0.056	0.77	8.32	10.7	15.3	64.2
	Head (Calc.)	100.00	0.35	3.35	8.61	100.0	100.0	100.0

The results obtained showed that additions of LS depressants had no significant effect on selectivity between Cu-Pb and pyrite. In a subsequent series of tests (Tests 70 to 73), the effect of depressant LS7 was compared with depressant LS3 and no LS depressant additions (Table No. 39).

Discussion - Continued

5.4.2. Effect of Different LS Depressant Mixtures on Copper-Lead Bulk Rougher and Cleaning - Cont'd

Table No. 39

Bulk Rougher and Cleaning Tests - Effect of Different Organic Depressants

Test No.	Depressant Used	Product	Weight %	Assays, %			% Distribution		
				Cu	Pb	Zn	Cu	Pb	Zn
70	0	Cu-Pb 3rd Cl. Conc.	12.32	2.27	18.7	7.99	81.7	68.9	11.8
		Cu-Pb 1st Cl. Conc.	19.73	1.50	12.91	8.82	86.5	76.2	20.9
		Cu-Pb Rougher Conc.	31.93	0.97	8.68	9.39	90.4	82.8	36.0
		Cu-Pb Flot. Tail.	68.07	0.048	0.84	7.80	9.6	17.2	64.0
		Head (Calc.)	100.00	0.34	3.34	8.30	100.0	100.0	100.0
71	LS-3 150 g/t Ro.+ 60 g/t Cl.	Cu-Pb 3rd Cl. Conc.	11.54	2.40	20.22	8.45	80.0	70.0	11.1
		Cu-Pb 1st Cl. Conc.	20.85	1.44	12.66	9.43	86.3	79.1	22.6
		Cu-Pb Rougher Conc.	33.88	0.92	8.35	9.63	90.0	84.6	37.3
		Cu-Pb Flot. Tail.	66.12	0.054	0.77	8.28	10.0	15.4	62.7
		Head (Calc.)	100.00	0.35	3.33	8.74	100.0	100.0	100.0
72	LS-7 150 g/t Ro.+ 60 g/t Cl.	Cu-Pb 3rd Cl. Conc.	10.07	2.59	20.3	8.52	78.0	64.1	9.8
		Cu-Pb 1st Cl. Conc.	18.96	1.50	12.84	9.34	85.0	76.3	20.3
		Cu-Pb Rougher Conc.	31.66	0.94	8.37	9.85	89.2	83.1	35.7
		Cu-Pb Flot. Tail.	68.34	0.053	0.79	8.21	10.8	16.9	64.3
		Head (Calc.)	100.00	0.34	3.19	8.73	100.0	100.0	100.0
73	LS-7 150 g/t Ro.+ 60 g/t Cl.	Cu-Pb Cl. Conc.	10.68	2.69	21.6	8.10	80.9	67.6	10.0
		Cu-Pb 1st Cl. Conc.	18.76	1.65	14.01	9.25	87.0	77.1	20.1
		Cu-Pb Ro. Conc.	32.80	0.99	8.78	10.04	91.3	84.5	38.1
		Cu-Pb Flot. Tail.	67.20	0.046	0.79	7.98	8.7	15.5	61.9
		Head (Calc.)	100.00	0.36	3.41	8.66	100.0	100.0	100.0

Test No. 73 was a reproducibility test of Test No. 72. The additions of LS3 depressant slightly improved selectivity between Cu-Pb and pyrite (Tests 70 and 71).

The reproducibility of the test procedure (Tests 72 and 73) was fairly good.

Discussion - Continued

5.4.3. Effect of LS3 Composition on Cu-Pb Flotation and Upgrading

In tests No. 116 to 119, different compositions of LS3 depressant were examined. The conditions and results for these tests are shown in Table No. 40.

Table No. 40

Effect of Composition of LS3 Depressant on Copper-Lead Rougher and Cleaning

a) Conditions

Test No.	Depressant Used	Composition, %		
		L-H	$ZnSO_4$	D1902
116	LS3	33.3	33.3	33.4
117	LS3A	50.0	-	50.0
118	LS3B	50.0	50.0	-
119	LS3C	50.0	15.0	35.0

Discussion - Continued

5.4.3. Effect of LS3 Composition on Cu-Pb Flotation and Upgrading - Cont'd

Table No. 40 - Cont'd

Effect of Composition of LS3 Depressant on Copper-Lead Rougher and Cleaning

b) Results

Test No.	Product	Weight %	Assays, %			% Distribution		
			Cu	Pb	Zn	Cu	Pb	Zn
116	Cu-Pb Cl. Conc.	11.99	2.37	18.06	10.08	82.9	67.4	14.5
	Cu-Pb Ro. Conc.	32.60	0.95	8.11	10.36	90.7	82.3	40.2
	Cu-Pb Flot. Tail.	67.40	0.047	0.85	7.48	9.3	17.7	59.8
	Head (Calc.)	100.00	0.34	3.22	8.42	100.0	100.0	100.0
117	Cu-Pb Cl. Conc.	11.32	2.50	19.4	9.20	82.8	66.9	12.6
	Cu-Pb Ro. Conc.	32.18	0.96	8.50	10.12	90.9	83.3	39.3
	Cu-Pb Flot. Tail.	67.82	0.046	0.81	7.43	9.1	16.7	60.7
	Head (Calc.)	100.00	0.34	3.28	8.30	100.0	100.0	100.0
118	Cu-Pb Cl. Conc.	13.41	2.10	16.90	9.67	81.2	69.8	15.1
	Cu-Pb Ro. Conc.	35.20	0.89	7.75	10.15	89.9	84.0	41.6
	Cu-Pb Flot. Tail.	64.80	0.054	0.80	7.73	10.1	16.0	58.4
	Head (Calc.)	100.00	0.35	3.25	8.58	100.0	100.0	100.0
119	Cu-Pb Cl. Conc.	12.48	2.33	18.2	9.74	81.7	68.2	14.3
	Cu-Pb Ro. Conc.	34.16	0.95	8.17	10.11	90.9	83.8	40.7
	Cu-Pb Flot. Tail.	65.84	0.049	0.82	7.64	9.1	16.2	59.3
	Head (Calc.)	100.00	0.36	3.33	8.48	100.0	100.0	100.0

The results obtained indicated that the variation in LS3 composition had no significant effect on Cu-Pb flotation and upgrading.

Discussion - Continued

5.4.4. Evaluation of LS3 Depressant on New Sample (Composite 4A)

Two comparative tests were conducted on the new ore sample to examine the effect of LS3 depressant on Cu-Pb bulk flotation and cleaning. These results are compared in Table No. 41.

Table No. 41

Evaluation of the Effect of LS3 on New Composite No. 4 - Comparison of Results

Test No.	LS-3 Added g/t	Product	Weight %	Assays, %			% Distribution		
				Cu	Pb	Zn	Cu	Pb	Zn
125	0	Cu-Pb Cl. Conc.	10.53	1.53	26.4	9.93	77.7	73.6	11.1
		Cu-Pb Ro. Conc.	31.72	0.57	9.99	11.50	86.8	83.9	38.7
		Cu-Pb Flot. Tail.	68.28	0.040	0.89	8.44	13.2	16.1	61.3
		Head (Calc.)	100.00	0.21	3.78	9.41	100.0	100.0	100.0
126	210	Cu-Pb Cl. Conc.	10.70	1.44	25.0	9.47	76.5	71.3	10.9
		Cu-Pb Ro. Conc.	31.84	0.56	10.00	11.50	88.2	85.2	39.5
		Cu-Pb Flot. Tail.	68.16	0.035	0.82	8.22	11.8	14.8	60.5
		Head (Calc.)	100.00	0.20	3.75	9.26	100.0	100.0	100.0

The results obtained indicated that additions of LS3 depressant had no significant effect on Cu-Pb and pyrite selectivity. Note that the new sample gave better Cu-Pb bulk concentrate grade than the original sample.

Discussion - Continued

5.4.5. Evaluation of LS3 Depressant - Cu-Pb Separation and Lead Upgrading Tests

Preliminary large scale (4 kg), rougher, cleaning, Cu-Pb separation and Pb upgrading tests were performed on the initial and new samples to compare the effect of LS3 depressant. The conditions and results for these tests are summarized in Table No. 42 (initial sample) and Table No. 43 (new sample).

Table No. 42

Cu-Pb Separation and Lead Upgrading Tests on Cu-Pb-Zn Ore From New Brunswick - Initial Composite

Test No.	LS3 Addition g/t	Product	Weight %	Assays, %			% Distribution		
				Cu	Pb	Zn	Cu	Pb	Zn
114	150	Cu Cleaner Conc.	1.19	18.6	3.07	4.04	67.2	1.1	0.6
		Cu Rougher Conc.	2.09	11.81	7.46	6.78	75.0	4.8	1.7
		Pb Conc.(Py. Flot. Tail.)	3.98	0.30	41.3	21.1	3.6	50.8	9.9
		Pyrite Cl. Conc.	7.93	0.11	4.42	1.89	2.6	10.8	1.8
		Cu-Pb Sep'n Tail.	12.47	0.18	16.92	8.43	6.8	65.2	12.4
		Cu-Pb Sep'n Feed	14.56	1.85	15.56	8.19	81.8	70.0	14.1
		Cu-Pb Flot. Conc.	36.68	0.82	7.49	9.52	91.0	84.9	41.1
		Cu-Pb Flot. Tail.	63.32	0.047	0.77	7.90	9.0	15.1	58.9
		Head (Calculated)	100.00	0.33	3.23	8.49	100.0	100.0	100.0
115	0	Cu Cleaner Conc.	1.09	19.0	5.77	4.26	61.1	2.0	0.6
		Cu Rougher Conc.	2.94	8.82	14.36	7.35	76.4	13.9	2.6
		Pb Conc.(Py. Flot. Tail.)	2.98	0.49	35.83	24.7	4.3	33.7	8.8
		Pyrite Cl. Conc.	3.73	0.92	4.26	1.70	1.0	5.0	0.8
		Cu-Pb Sep'n Tail.	11.28	0.24	16.21	8.81	8.0	57.7	11.9
		Cu-Pb Sep'n Feed	14.22	2.01	15.83	8.51	84.4	71.1	14.5
		Cu-Pb Ro. Conc.	34.16	0.91	7.76	9.64	91.2	83.7	39.4
		Cu-Pb Flot. Tail.	65.84	0.045	0.79	7.72	8.8	16.3	60.6
		Head (Calculated)	100.00	0.34	3.17	8.38	100.0	100.0	100.0

The results obtained in these tests indicated the following:

1. The new sample gave better Cu-Pb bulk rougher grade and recovery (Table No. 43) as compared to the initial sample (Table No. 42) but Cu-Pb separation on the new sample was not possible to achieve. The main reason for this was the low copper content of the new sample.
2. The addition of LS3 depressant had only a slight positive effect on Cu-Pb separation and lead upgrading (initial sample).

Discussion - Continued

5.4.5. Evaluation of LS3 Depressant - Cu-Pb Separation and Lead Upgrading Tests - Cont'd

Table No. 43

Cu-Pb Separation and Lead Upgrading Tests on Cu-Pb-Zn Ore From New Brunswick - New Composite

Test No.	LS3 Addition g/t	Product	Weight %	Assays, %			% Distribution		
				Cu	Pb	Zn	Cu	Pb	Zn
127	0	Cu Cleaner Conc.	0.75	10.8	36.1	3.82	40.8	7.3	0.3
		Cu Rougher Conc.	2.90	4.13	37.8	6.48	60.3	29.6	2.0
		Pb Conc. (Py. Flot. Tail.)	2.74	0.46	38.5	23.9	6.4	28.7	7.0
		Pyrite Cl. Conc.	3.09	0.30	6.26	1.98	4.7	5.2	0.6
		Cu-Pb Sep'n Tail.	7.89	0.41	20.1	10.5	16.2	42.9	8.8
		Cu-Pb Sep'n Feed	10.79	1.41	24.8	9.40	76.5	72.5	10.8
		Cu-Pb Ro. Conc.	32.43	0.53	9.45	11.20	86.7	83.0	38.6
		Cu-Pb Flot. Tail.	67.57	0.039	0.92	8.58	13.3	17.0	61.4
		Head (Calculated)	100.00	0.20	3.69	9.43	100.0	100.0	100.0
128	150	Cu Cleaner Conc.	0.64	10.2	38.3	4.05	33.5	6.8	0.3
		Cu Rougher Conc.	2.37	4.24	39.9	6.16	51.5	26.1	1.7
		Pb Conc. (Py. Flot. Tail.)	3.49	0.69	37.1	17.70	12.3	35.7	6.7
		Pyrite Cl. Conc.	2.05	0.63	6.85	2.13	6.6	3.9	0.5
		Cu-Pb Sep'n Tail.	7.16	0.62	22.50	10.10	22.6	44.4	7.9
		Cu-Pb Sep'n Feed	9.53	1.52	26.80	9.11	74.1	70.5	9.6
		Cu-Pb Ro. Conc.	31.27	0.54	9.65	11.00	86.2	83.2	37.7
		Cu-Pb Flot. Tail.	68.73	0.039	0.89	8.33	13.8	16.8	62.3
		Head (Calculated)	100.00	0.19	3.63	9.18	100.0	100.0	100.0

Discussion - Continued

6. Evaluation of LS Depressants on Kidd Creek Cu-Pb-Zn-Ag Ore

6.1. Description of Sample Used for Flotation Testwork

The ore used in this study was typical "C" ore that is currently treated at Kidd Creek concentrator. The head analysis of the laboratory sample was as follows:

Copper (Cu) = 0.55 %
Lead (Pb) = 1.22 %
Zinc (Zn) = 7.05 %
Iron (Fe) = 20.80 %
Sulphur (S) = 21.5 %
Gold (Au) = 0.05 g/t
Silver (Ag) = 259.00 g/t

This ore belongs to a massive sphalerite-pyrite zone containing native silver and galena. This ore also contained appreciable amounts of pyrrhotite.

6.2. Laboratory Procedure for Testing Cu-Pb-Zn-Ag Ore From Kidd Creek Mines

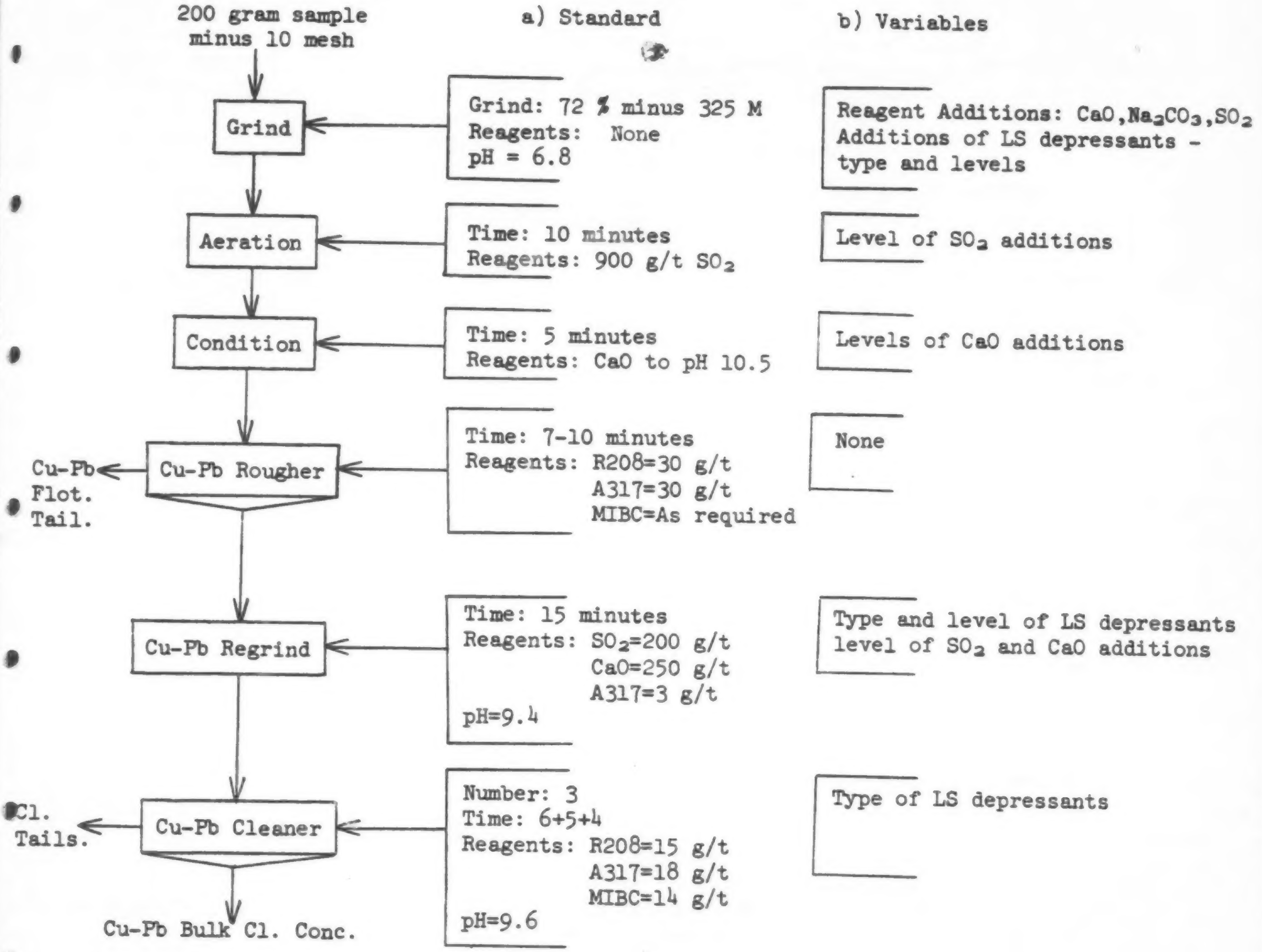
The laboratory procedure used for testing of this ore is shown in Figure No. 18. This flowsheet is different from that of the concentrator (Figure No. 19) and utilizes a Cu-Pb bulk flotation procedure instead of Cu-Pb sequential flotation. The Cu-Pb bulk flotation procedure was selected to simplify the flowsheet for testing the LS depressants.

Discussion - Continued

6.2. Laboratory Procedure for Testing Cu-Pb-Zn-Ag Ore From Kidd Creek Mines - Cont'd

Figure No. 18

Schematic Outline of Laboratory Procedure Used for LS Depressant Evaluation

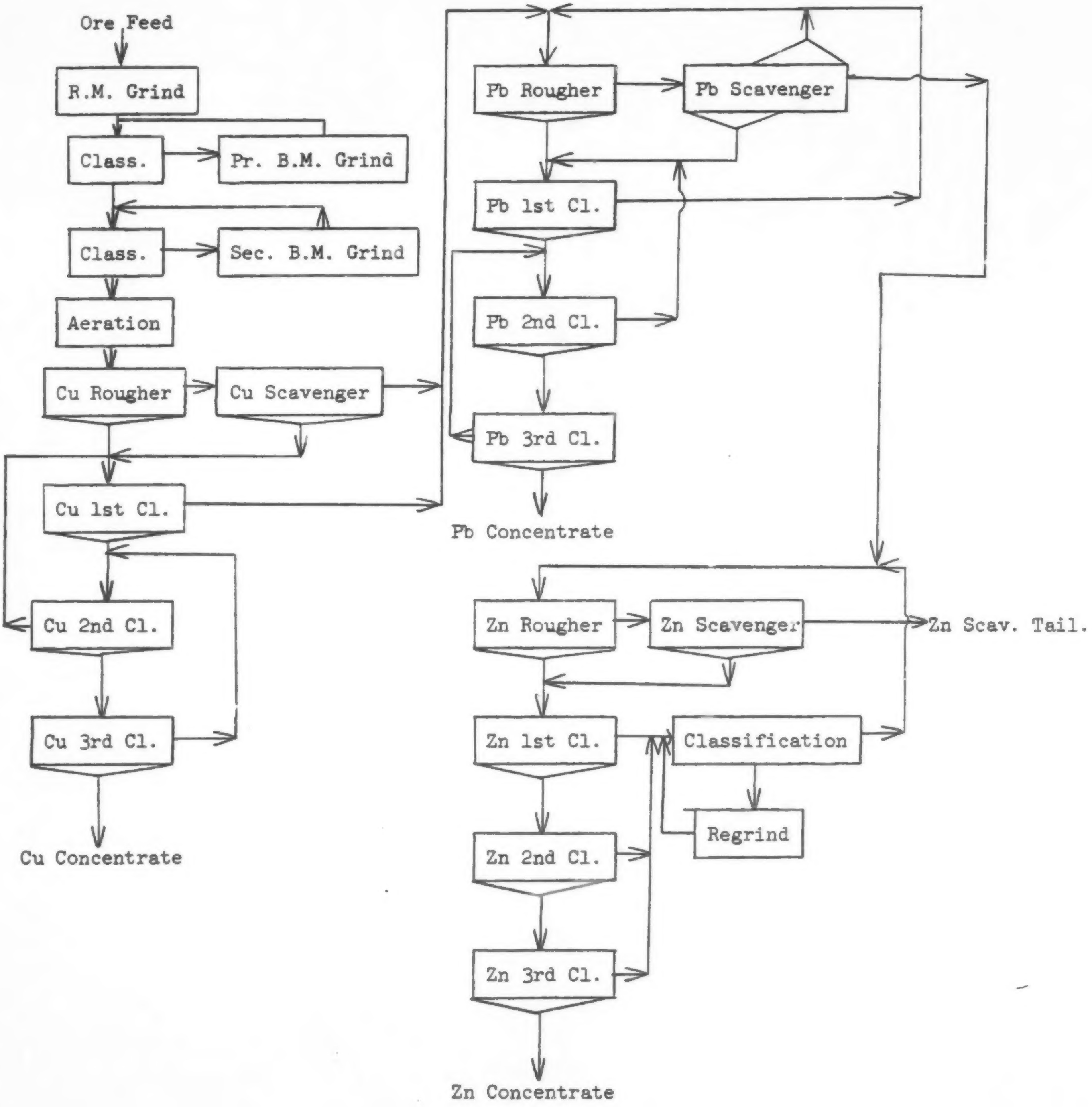

200 gram sample minus 10 mesh
a) Standard
b) Variables
Grind
Grind: 72 % minus 325 M
Reagents: None
pH = 6.8
Reagent Additions: CaO,Na_2CO_3,SO_2
Additions of LS depressants - type and levels
Aeration
Time: 10 minutes
Reagents: 900 g/t SO_2
Level of SO_2 additions
Condition
Time: 5 minutes
Reagents: CaO to pH 10.5
Levels of CaO additions
Cu-Pb Flot. Tail.
Cu-Pb Rougher
Time: 7-10 minutes
Reagents: R208=30 g/t
A317=30 g/t
MIBC=As required
None
Cu-Pb Regrind
Time: 15 minutes
Reagents: SO_2=200 g/t
CaO=250 g/t
A317=3 g/t
pH=9.4
Type and level of LS depressants
level of SO_2 and CaO additions
Cl. Tails.
Cu-Pb Cleaner
Number: 3
Time: 6+5+4
Reagents: R208=15 g/t
A317=18 g/t
MIBC=14 g/t
pH=9.6
Type of LS depressants
Cu-Pb Bulk Cl. Conc.

Discussion - Continued

6.2. Laboratory Procedure for Testing Cu-Pb-Zn-Ag Ore From Kidd Creek Mines - Cont'd

Figure No. 19

Kidd Creek Concentrator Flowsheet for Treatment of Cu-Pb-Zn Ore


Ore Feed
R.M. Grind
Class.
Pr. B.M. Grind
Class.
Sec. B.M. Grind
Aeration
Cu Rougher
Cu Scavenger
Cu 1st Cl.
Cu 2nd Cl.
Cu 3rd Cl.
Cu Concentrate
Pb Rougher
Pb Scavenger
Pb 1st Cl.
Pb 2nd Cl.
Pb 3rd Cl.
Pb Concentrate
Zn Rougher
Zn Scavenger
Zn Scav. Tail.
Zn 1st Cl.
Classification
Regrind
Zn 2nd Cl.
Zn 3rd Cl.
Zn Concentrate

Discussion - Continued

6.3. Concentrator Metallurgical Results

Typical results obtained at Kidd Creek concentrator are summarized in Table No. 44.

Table No. 44

Plant Metallurgical Results on Ag-Cu-Pb-Zn "C" Ore

Product	Assays, %, g/t				% Distribution			
	Cu	Pb	Zn	Ag	Cu	Pb	Zn	Ag
Feed	0.42	0.64	7.18	204	100.0	100.0	100.0	100.0
Cu Concentrate	19.25	8.52	4.31	8730	38.6	11.6	0.5	40.4
Pb Concentrate	7.11	13.16	7.12	1744	30.5	37.1	1.8	16.2
Zn Concentrate	0.54	0.97	50.63	244	12.7	16.6	78.1	14.1
Final Tailing	0.09	0.26	1.70	70.0	18.2	37.7	19.6	29.3

6.4. Laboratory Testwork

Only a brief evaluation of several LS depressants was performed on this ore at the end of the test program. The variables tested included type of LS depressants, and comparison of LS3 depressant with standard reagents (Lime and SO_2).

6.4.1. Preliminary Flotation Tests with Different LS Depressants

A series of three preliminary copper-lead rougher and cleaning tests were conducted on this ore to establish preliminary conditions for more detailed evaluation of LS depressants. The results and conditions for these tests are summarized in Table No. 45.

In all tests the selectivity between copper-lead and pyrite was poor and low grade Cu-Pb bulk concentrates were produced. It appeared that the levels of SO_2 and lime were too high when using LS depressants.

Discussion - Continued

6.4.1. Preliminary Flotation Tests with Different LS Depressants - Cont'd

Table No. 45

Evaluation of Organic Depressants Using Texas Gulf Cu-Pb-Zn Ore - C Type(Preliminary Tests

a) Conditions

Test	Reagent Additions, grams per tonne				pH	
No.	SO_2	CaO	LS3	LS7	Ro.	Cl.
143	660	1600	-	-	10.5	11.0
145	660	1600	215	-	10.5	11.0
146	660	1600	-	215	10.5	11.0

b) Results

Test	Product	Weight	Assays, %			% Distribution		
No.		%	Cu	Pb	Zn	Cu	Pb	Zn
143	Cu-Pb Cl. Conc.	10.62	5.19	5.41	10.1	91.3	45.0	15.3
	Cu-Pb Ro. Conc.	25.36	2.27	3.68	8.95	95.2	73.2	32.4
	Cu-Pb Flot. Tail.	74.64	0.039	0.46	6.32	4.8	26.8	67.6
	Head (Calc.)	100.00	0.60	1.28	6.99	100.0	100.0	100.0
145	Cu-Pb Cl. Conc.	8.70	6.09	4.30	10.2	89.0	29.3	12.8
	Cu-Pb Ro. Conc.	24.34	2.32	3.82	9.74	94.8	72.8	34.2
	Cu-Pb Flot. Tail.	75.66	0.041	0.46	6.05	5.2	27.2	65.8
	Head (Calc.)	100.00	0.60	1.28	6.95	100.0	100.0	100.0
146	Cu-Pb Cl. Conc.	8.27	6.41	6.43	11.0	87.5	40.6	12.7
	Cu-Pb Ro. Conc.	24.40	2.34	3.79	9.72	94.4	70.5	33.1
	Cu-Pb Flot. Tail.	75.60	0.045	0.51	6.31	5.6	29.5	66.9
	Head (Calc.)	100.00	0.61	1.31	7.14	100.0	100.0	100.0

Discussion - Continued

6.4.2. Effect of LS3 Depressant on Cu-Pb Rougher and Cleaning Using Reduced Lime and SO_2 Additions

Two comparative tests were conducted to examine the effect of LS3 depressant on Cu-Pb bulk rougher and cleaning. The results for these tests are shown in Table No. 46.

Table No. 46

Effect of LS3 Additions on Cu-Pb Rougher and Cleaning - Comparison of Results

Test No.	LS3 Added g/t	Product	Weight %	Assays, %			% Distribution		
				Cu	Pb	Zn	Cu	Pb	Zn
163	230	Cu-Pb Cl. Conc.	6.56	7.92	10.8	8.41	86.1	60.7	7.8
		Cu-Pb Ro. Conc.	16.64	3.33	5.36	12.31	91.9	76.5	29.0
		Cu-Pb Flot. Tail.	83.36	0.058	0.33	6.06	8.1	23.5	71.0
		Head (Calc.)	100.00	0.60	1.17	7.10	100.0	100.0	100.0
164	0	Cu-Pb Cl. Conc.	10.03	5.61	8.48	8.92	90.6	65.1	12.5
		Cu-Pb Ro. Conc.	23.03	2.54	4.24	10.83	94.1	74.4	34.9
		Cu-Pb Flot. Tail.	76.97	0.048	0.43	6.04	5.9	25.3	65.1
		Head (Calc.)	100.00	0.62	1.31	7.14	100.0	100.0	100.0

Test No. 163 was performed with reduced lime and SO_2 additions. All lime was added to the grind along with a small amount of SO_2 and 150 g/t LS3 depressant.

With additions of LS3 depressant (Test No. 163), the selectivity between Cu-Pb and pyrite improved significantly.

SAMPLE PREPARATION

Samples of Cu-Zn ore from Noranda Mines (Geco), Cu-Zn and Cu-Pb-Zn ore from Kidd Creek Mine, Pb-Zn ore from Cyprus Anvil and Cu-Pb-Zn ore from New Brunswick were received during the month of October, 1982. An additional sample of Cu-Pb-Zn ore from New Brunswick was received in May 1983.

In preparation for laboratory testwork, each sample was air dried, crushed to 10 mesh and riffled into 2 kilogram charges. From each ore a head sample for assay was removed.

The test charges and rejects were stored in the freezer at minus 5°C.

The ore samples were marked as follows:

a) Composite No. 1 = Cu-Zn Ore (Noranda Mines-Geco)
b) Composite No. 2 = Cu-Zn Ore (Texas Gulf Kidd Creek Ore A)
c) Composite No. 3 = Ag-Cu-Pb-Zn Ore (Texas Gulf Kidd Creek Ore C)
d) Composite No. 4 = Cu-Pb-Zn Ore (New Brunswick - Initial Sample)
e) Composite No. 4A = Cu-Pb-Zn Ore (New Brunswick - New Sample)
f) Composite No. 5 = Pb-Zn Ore (Cyprus Anvil - Faro 3 Zone)

LIST OF LABORATORY TESTS

Test No.	Comp. No.	Ore Type	Test Procedure Performed	Remarks
1	1	Cu-Zn	Cu Ro.+Cl.,Zn Ro.+Cl.	Standard Test
2	5	Pb-Zn	Pb Ro.+Cl.,Zn Ro.+Cl.	Standard Test
3	1	Cu-Zn	Cu Ro.+Cl.,Zn Ro.+Cl.	Standard Test
4	4	Cu-Pb-Zn	Cu-Pb Ro.+Cl.,Cu-Pb Sep'n,Zn Ro.+Cl.	Standard Test
5	5	Pb-Zn	Pb Ro.+Cl.,Zn Ro.+Cl.	Standard Test
6	5	Pb-Zn	Pb Ro.+Cl.,Zn Ro.+Cl.	Standard Test
7	4	Cu-Pb-Zn	Cu-Pb Rougher	Stage Roughing
8	4	Cu-Pb-Zn	Cu-Pb Rougher	Stage Roughing
9	4	Cu-Pb-Zn	Cu-Pb Rougher	Stage Roughing
10	4	Cu-Pb-Zn	Cu-Pb Rougher	Stage Roughing
11	5	Pb-Zn	Pb Ro.+Cl.,Zn Rougher	Standard Test
12	5	Pb-Zn	Pb Rougher, Zn Rougher	Ro. Test with Dep. LS-1
13	5	Pb-Zn	Pb Rougher, Zn Rougher	Ro. Test with Dep. LS-1
14	5	Pb-Zn	Pb Rougher, Zn Rougher	Ro. Test with Dep. LS-2
15	5	Pb-Zn	Pb Rougher, Zn Rougher	Ro. Test with Dep. LS-3
16	5	Pb-Zn	Pb Rougher, Zn Rougher	Ro. Test with NaCN
17	5	Pb-Zn	Pb Rougher, Zn Rougher	Ro. Test with no Dep.
18	1	Cu-Zn	Cu Rougher, Zn Rougher	Ro. Test with NaCN
19	1	Cu-Zn	Cu Rougher, Zn Rougher	Ro. Test with Dep. LS-1
20	1	Cu-Zn	Cu Rougher, Zn Rougher	Ro. Test with Dep. LS-2
21	1	Cu-Zn	Cu Rougher, Zn Rougher	Ro. Test with Dep. LS-3
22	4	Cu-Pb-Zn	Cu-Pb Rougher	Stage Ro. with Dep. LS-1
23	4	Cu-Pb-Zn	Cu-Pb Rougher	Stage Ro. with Dep. LS-2
24	4	Cu-Pb-Zn	Cu-Pb Rougher	Stage Ro. with Dep. LS-3
25	1	Cu-Zn	Cu Rougher	Stage Ro. with NaCN
26	1	Cu-Zn	Cu Rougher	Stage Ro. with Dep. LS-3
27	1	Cu-Zn	Cu Rougher	Stage Ro. with Dep. LS-1
28	1	Cu-Zn	Cu Rougher	Stage Ro. with Dep. LS-2
29	1	Cu-Zn	Cu Rougher	Stage Ro. with no Dep.
30	1	Cu-Zn	Cu Rougher	Stage Ro. with Dep. LS-4
31	1	Cu-Zn	Cu Rougher	Stage Ro. with Dep. LS-5
32	1	Cu-Zn	Cu Rougher	Stage Ro. with Dep. LS-6
33	1	Cu-Zn	Cu Ro.+Cl.,Zn Ro.+Cl.	Standard Test
34	1	Cu-Zn	Cu Rougher, Zn Rougher	Stage Rougher with NaCN
35	1	Cu-Zn	Cu Rougher, Zn Rougher	Stage Rougher with Dep. LS-3
36	1	Cu-Zn	Cu Rougher, Zn Rougher	Stage Rougher with Dep. LS-3
37	5	Pb-Zn	Pb Rougher, Zn Rougher	Stage Ro. with Dep. LS-3
38	5	Pb-Zn	Pb Rougher, Zn Rougher	Stage Ro. with Dep. LS-6
39	5	Pb-Zn	Pb Ro.+Cl.,Zn Ro.+Cl.	Standard Test
40	2	Cu-Zn	Cu Rougher	Stage Rougher
41	2	Cu-Zn	Cu Rougher	Stage Ro. with Dep. LS-1
42	5	Pb-Zn	Pb Rougher, Zn Rougher	Stage Rougher
43	5	Pb-Zn	Pb Rougher, Zn Rougher	Stage Ro. with Dep. LS-3
44	5	Pb-Zn	Pb Rougher, Zn Rougher	Stage Ro. with Dep. LS-3
45	5	Pb-Zn	Pb Rougher, Zn Rougher	Stage Ro. no Dep.
46	1	Cu-Zn	Cu Ro.+Cl.,Zn Ro.+Cl.	Standard Test
47	1	Cu-Zn	Cu Ro.+Cl.,Zn Ro.+Cl.	Standard Test with Dep. LS-3

List of Laboratory Tests - Cont'd

Test No.	Comp. No.	Ore Type	Test Procedure Performed	Remarks
48	5	Pb-Zn	Pb Rougher	Stage Ro. with Dep. LS-7
49	5	Pb-Zn	Pb Rougher	Stage Ro. with Dep. LS-8
50	5	Pb-Zn	Pb Rougher+Cleaners	Standard Pb Circuit
51	5	Pb-Zn	Pb Rougher+Cleaners	Standard Pb Circuit
52	5	Pb-Zn	Pb Rougher+Cleaners	Standard Pb Circuit
53	1	Cu-Zn	Cu Rougher	Stage Ro. with Dep. LS-3
54	1	Cu-Zn	Cu Rougher	Stage Ro. with Dep. LS-3
55	1	Cu-Zn	Cu Rougher	Stage Ro. with Dep. LS-7
56	1	Cu-Zn	Cu Rougher	Stage Ro. with Dep. LS-7
57	1	Cu-Zn	Cu Rougher	Stage Ro. with Dep. LS-8
58	1	Cu-Zn	Cu Rougher	Stage Ro. with Dep. LS-8
59	1	Cu-Zn	Cu Rougher	Stage Ro. with no Dep.
60	1	Cu-Zn	Cu Rougher	Stage Ro. with NaCN
61	1	Cu-Zn	Cu Rougher	Stage Ro. with LS-8,no coll.
62	1	Cu-Zn	Cu Rougher	Stage Ro. with no Dep.or coll.
63	5	Pb-Zn	Pb Rougher	Stage Ro. with Dep. LS-7
64	5	Pb-Zn	Pb Rougher+Cleaners	Pb Circuit with Dep. LS-7
65	5	Pb-Zn	Pb Rougher+Cleaners	Pb Circuit with Dep. LS-7
66	5	Pb-Zn	Pb Rougher+Cleaners	Pb Circuit with Dep. LS-7
67	5	Pb-Zn	Pb Rougher+Cleaners	Pb Circuit with Dep. LS-7
68	5	Pb-Zn	Pb Rougher+Cleaners	Pb Circuit with no Dep.
69	5	Pb-Zn	Pb Rougher+Cleaners	Pb Circuit with Dep. LS-7
70	4	Cu-Pb-Zn	Cu-Pb Rougher+Cleaners	Cu-Pb Circuit with no Dep.
71	4	Cu-Pb-Zn	Cu-Pb Rougher+Cleaners	Cu-Pb Circuit with Dep. LS-3
72	4	Cu-Pb-Zn	Cu-Pb Rougher+Cleaners	Cu-Pb Circuit with Dep. LS-7
73	4	Cu-Pb-Zn	Cu-Pb Rougher+Cleaners	Cu-Pb Circuit with Dep. LS-8
74	1	Cu-Zn	Cu Rougher+Cleaners	Cu Circuit with Dep. LS-8
75	1	Cu-Zn	Cu Rougher+Cleaners	Cu Circuit with Dep. LS-8
76	1	Cu-Zn	Cu Rougher+Cleaners	Cu Circuit with Dep. LS-8
77	1	Cu-Zn	Cu Rougher+Cleaners	Cu Circuit with Dep. LS-8
78	1	Cu-Zn	Cu Rougher+Cleaners	Cu Circuit with Dep. LS-8
79	1	Cu-Zn	Cu Rougher+Cleaners	Cu Circuit with Dep. LS-8
80	1	Cu-Zn	Cu Rougher+Cleaners	Cu Circuit with NaCN
81	1	Cu-Zn	Cu Rougher+Cleaners	Cu Circuit with NaCN
82	4	Cu-Pb-Zn	Cu-Pb Rougher+Cleaners	Cu-Pb Circuit with Dep. LS-3
83	4	Cu-Pb-Zn	Cu-Pb Rougher+Cleaners	Cu-Pb Circuit with no Dep.
84	5	Pb-Zn	Pb Rougher+Cleaners	Pb Circuit with no Dep.
85	5	Pb-Zn	Pb Rougher+Cleaners	Pb Circuit with no Dep.
86	5	Pb-Zn	Pb Rougher+Cleaners	Pb Circuit with incr. NaCN
87	5	Pb-Zn	Pb Rougher+Cleaners	Pb Circuit with Dep. LS-7
88	5	Pb-Zn	Pb Rougher+Cleaners	Pb Circuit with Dep. LS-7
89	5	Pb-Zn	Pb Rougher+Cleaners	Pb Circuit with Dep. LS-7
90	5	Pb-Zn	Pb Rougher+Cleaners	Pb Circuit with Dep. LS-3
91	5	Pb-Zn	Pb Rougher+Cleaners	Pb Circuit with Dep. LS-3A
92	5	Pb-Zn	Pb Rougher+Cleaners	Pb Circuit with Dep. LS-3B
93	5	Pb-Zn	Pb Rougher+Cleaners	Pb Circuit with Dep. LS-3C

List of Laboratory Tests - Cont'd

Test No.	Comp. No.	Ore Type	Test Procedure Performed	Remarks
94	1	Cu-Zn	Cu Rougher+Cleaners	Cu Circuit with Dep. LS-3
95	1	Cu-Zn	Cu Rougher+Cleaners	Cu Circuit with Dep. LS-3A
96	1	Cu-Zn	Cu Rougher+Cleaners	Cu Circuit with Dep. LS-3B
97	1	Cu-Zn	Cu Rougher+Cleaners	Cu Circuit with Dep. LS-3C
98	5	Pb-Zn	Pb Ro.+Cl.,Zn Ro.+Cl.	Standard Test, no Dep.
99	1	Cu-Zn	Cu Ro.+Cl.,Zn Ro.+Cl.	Standard Test with Dep. LS-3
100	5	Pb-Zn	Pb Ro.+Cl.,Zn Ro.+Cl.	Standard Test with Dep. LS-3B
101	5	Pb-Zn	Pb Ro.+Cl.,Zn Ro.+Cl.	Standard Test with Dep. LS-3B
102	5	Pb-Zn	Pb Ro.+Cl.,Zn Ro.+Cl.	Standard Test with no Dep.
103	5	Pb-Zn	Pb Ro.+Cl.,Zn Ro.+Cl.	Standard Test with Dep. LS-3B
104	5	Pb-Zn	Pb Ro.+Cl.,Zn Ro.+Cl.	Standard Test with Dep. LS-3B
105	1	Cu-Zn	Cu Ro.+Cl.,Zn Ro.+Cl.	Standard Test with Dep. LS-3
106	5	Pb-Zn	Pb Ro.+Cl.,Zn Ro.+Cl.	Standard Test with no Dep.
107	5	Pb-Zn	Pb Ro.+Cl.,Zn Ro.+Cl.	Standard Test with no Dep.
108	1	Cu-Zn	Cu Ro.+Cl.,Zn Ro.+Cl.	Standard Test with NaCN
109	1	Cu-Zn	Cu Ro.+Cl.,Zn Ro.+Cl.	Standard Test with NaCN
110	1	Cu-Zn	Cu Ro.+Cl.,Zn Ro.+Cl.	Standard Test with no Dep.
111	1	Cu-Zn	Cu Ro.+Cl.,Zn Ro.+Cl.	Standard Test with no Dep.
112	1	Cu-Zn	Cu Ro.+Cl.,Zn Ro.+Cl.	Standard Test with NaCN
113	1	Cu-Zn	Cu Ro.+Cl.,Zn Ro.+Cl.	Standard Test with NaCN
114	4	Cu-Pb-Zn	Cu-Pb Ro.+Cl.+Cu-Pb Sep'n	Cu+Pb Circuits with Dep.LS-3
115	4	Cu-Pb-Zn	Cu-Pb Ro.+Cl.+Sep'n+Pb Upgrading	Cu+Pb Circuits with no Dep.
116	4	Cu-Pb-Zn	Cu-Pb Ro.+Cl.+Sep'n+Pb Upgrading	Cu+Pb Circuits with Dep.LS-3
117	4	Cu-Pb-Zn	Cu-Pb Rougher+Cleaners	Cu-Pb Circuit with Dep. LS-3A
118	4	Cu-Pb-Zn	Cu-Pb Rougher+Cleaners	Cu-Pb Circuit with Dep. LS-3B
119	4	Cu-Pb-Zn	Cu-Pb Rougher+Cleaners	Cu-Pb Circuit with Dep. LS-3C
120	4	Cu-Pb-Zn	Cu-Pb Ro.+Cl.+Sep'n+Pb Upgrading	Cu+Pb Circuits with Dep. LS-3
121	4A	Cu-Pb-Zn	Cu-Pb Rougher+Cleaners	Cu-Pb Circuit with Dep. LS-3
122	4	Cu-Pb-Zn	Cu-Pb Rougher+Cleaners	Cu-Pb Circuit with Dep. LS-3
123	4	Cu-Pb-Zn	Cu-Pb Rougher+Cleaners	Cu-Pb Circuit with no Dep.
124	4	Cu-Pb-Zn	Cu-Pb Rougher+Cleaners	Cu-Pb Circuit with Dep. LS-3
125	4A	Cu-Pb-Zn	Cu-Pb Rougher+Cleaners	Cu-Pb Circuit with no Dep.
126	4A	Cu-Pb-Zn	Cu-Pb Rougher+Cleaners	Cu-Pb Circuit with Dep. LS-3
127	4A	Cu-Pb-Zn	Cu-Pb Ro.+Cl.+Sep'n+Pb Upgrading	Cu+Pb Circuits with no Dep.
128	4A	Cu-Pb-Zn	Cu-Pb Ro.+Cl.+Sep'n+Pb Upgrading	Cu+Pb Circuits with Dep. LS-3
129	4A	Cu-Pb-Zn	Cu-Pb Ro.+Cl.+Sep'n+Pb Upgrading	Cu+Pb Circuits with Dep. LS-3
130	4A	Cu-Pb-Zn	Cu-Pb Ro.+Cl.+Sep'n+Pb Upgrading	Cu+Pb Circuits with Dep. LS-3
131	2	Cu-Zn	Cu Rougher+Cleaners	Cu Circuit with no Dep.
132	2	Cu-Zn	Cu Rougher+Cleaners	Cu Circuit with Dep. LS-1
133	2	Cu-Zn	Cu Rougher+Cleaners	Cu Circuit with Dep. LS-2
134	2	Cu-Zn	Cu Rougher+Cleaners	Cu Circuit with Dep. LS-3
135	2	Cu-Zn	Cu Rougher+Cleaners	Cu Circuit with Dep. LS-7
136	2	Cu-Zn	Cu Rougher+Cleaners	Cu Circuit with Dep. LS-8
137	2	Cu-Zn	Cu Rougher+Cleaners	Cu Circuit with no Dep.
138	2	Cu-Zn	Cu Rougher+Cleaners	Cu Circuit with Dep. LS-3
139	2	Cu-Zn	Cu Rougher+Cleaners	Cu Circuit with Dep. LS-8

List of Laboratory Tests - Cont'd

Test No.	Comp. No.	Ore Type	Test Procedure Performed	Remarks
140	2	Cu-Zn	Cu Rougher+Cleaners	Cu Circuit with no Dep.
141	2	Cu-Zn	Cu Rougher+Cleaners	Cu Circuit with no Dep.
142	2	Cu-Zn	Cu Rougher+Cleaners	Cu Circuit with Dep. LS-3
143	3	Cu-Pb-Zn	Cu-Pb Rougher+Cleaners	Cu-Pb Circuit with no Dep.
144	3	Cu-Pb-Zn	Cu-Pb Rougher+Cleaners	Cu-Pb Circuit with no Dep.
145	3	Cu-Pb-Zn	Cu-Pb Rougher+Cleaners	Cu-Pb Circuit with Dep.LS-3
146	3	Cu-Pb-Zn	Cu-Pb Rougher+Cleaners	Cu-Pb Circuit with Dep.LS-7
147	3	Cu-Pb-Zn	Cu-Pb Rougher+Cleaners	Cu-Pb Circuit with Dep.LS-8
148	2	Cu-Zn	Cu Rougher+Cleaners	Cu Circuit with no Dep.
149	2	Cu-Zn	Cu Ro.+Cl.,Zn Ro.+Cl.	Standard Test with no Dep.
150	2	Cu-Zn	Cu Rougher+Cleaners	Cu Circuit with Dep. LS-3
151	2	Cu-Zn	Cu Ro.+Cl.,Zn Ro.+Cl.	Standard Test with Dep.LS-3
152	3	Cu-Pb-Zn	Cu-Pb Rougher+Cleaners	Cu-Pb Circuit with no Dep.
153	2	Cu-Zn	Cu Ro.+Cl.,Zn Ro.+Cl.	Standard Test with no Dep.
154	2	Cu-Zn	Cu Ro.+Cl.,Zn Ro.+Cl.	Standard Test with Dep. LS-3
155	2	Cu-Zn	Cu Ro.+Cl.,Zn Ro.+Cl.	Standard Test with Dep. LS-3
156	2	Cu-Zn	Cu Ro.+Cl.,Zn Ro.+Cl.	Standard Test with Dep. LS-3
157	3	Cu-Pb-Zn	Cu-Pb Ro.+Cl.+Sep'n	Cu+Pb Circuits with Dep.LS-3
158	4	Cu-Pb-Zn	Cu-Pb Rougher+Cleaners	Cu-Pb Circuit with Dep. LS-3
159	2	Cu-Zn	Cu Ro.+Cl.,Zn Ro.+Cl.	Standard Test with no Dep.
160	2	Cu-Zn	Cu Ro.+Cl.,Zn Ro.+Cl.	Standard Test with no Dep.
161	4	Cu-Pb-Zn	Cu-Pb Rougher+Cleaners	Cu-Pb Circuit with Dep. LS-3
162	3	Cu-Pb-Zn	Cu-Pb Rougher+Cleaners	Cu-Pb Circuit with no Dep.
163	3	Cu-Pb-Zn	Cu-Pb Rougher+Cleaners	Cu-Pb Circuit with Dep. LS-3
164	3	Cu-Pb-Zn	Cu-Pb Rougher+Cleaners	Cu-Pb Circuit with no Dep.
165	2	Cu-Zn	Cu Ro.+Cl.,Zn Ro.+Cl.	Standard Test with no Dep.
166	3	Cu-Pb-Zn	Cu-Pb Ro.+Cl.+Sep'n,Zn Ro.+Cl.	Standard Test with Dep. LS-3
167	3	Cu-Pb-Zn	Cu-Pb Ro.+Cl.+Sep'n,Zn Ro.+Cl.	Standard Test with no Dep.

DETAILS OF TESTS

Test No. 1

Purpose:	To establish a standard laboratory flotation procedure for Cu-Zn ore Composite 1.
Procedure:	As below.
Feed:	2 kg -10 mesh Composite 1.
Grind:	30 minutes in lab ball mill with 12.7 kg steel balls at 66 % solids.
Conditions:	

Stage	Reagents Added, grams per tonne							Time, minutes			pH
	NH_4-OH	NaCN	R350	Pine Oil	SO_2	R343	MIBC	Grind	Cond.	Froth	
Grind	150	35	-	-	-	-	-	30	-	-	-
Condition	-	25	-	-	-	-	-	-	2	-	9.2
Aeration	-	-	-	-	-	-	-	-	10	-	-
Cu Ro. Condition	-	-	4	10	-	-	-	-	10	2	9.0
Cu Rougher	-	-	2	-	-	-	-	-	1	2	-
Cu Scavenger	-	-	2	10	-	-	-	-	1	3	-
Clean Cu rougher concentrate											
Cu Cl. Cond.	-	-	-	-	1300	-	-	-	15	-	4.5
Cu 1st Cl.	-	-	-	-	-	-	2	-	1	2	-
	-	-	-	-	-	5	2	-	1	2	-
Cu 2nd Cl.	-	-	-	-	50	-	-	-	2	3	4.5
Cu 3rd Cl.	-	-	-	-	40	-	2	-	2	2	4.5

Test No. 1 - Continued

Conditions:

Stage	Reagents Added, grams per tonne				Time, minutes			pH
	NH_4OH	$CuSO_4$	R343	Pine Oil	Grind	Cond.	Froth	
Zn Ro. Cond.	100	200	-	-	-	10	-	9.2
Zn Rougher	-	-	20	10	-	1	3	-
Zn Scavenger	-	-	10	-	-	1	2	-
Clean Zn rougher concentrate								
Zn 1st Cl.	100	-	-	-	-	1	2	10.2
Zn 2nd Cl.	100	-	-	-	-	1	1.5	10.4
Zn 3rd Cl.	100	-	-	-	-	1	1	10.5

Metallurgical Results

Product	Weight %	Assays, %		% Distribution	
		Cu	Zn	Cu	Zn
1. Cu Cleaner Conc.	5.08	26.9	4.20	78.9	6.3
2. Cu 3rd Cl. Tail.	0.15	5.31	20.8	0.5	0.9
3. Cu 2nd Cl. Tail.	0.40	2.42	14.3	0.6	1.8
4. Cu 1st Cl. Tail.	2.58	0.82	6.66	1.2	5.0
5. Cu Scav. Conc.	3.08	8.33	10.0	14.8	9.0
6. Zn Cl. Conc.	5.27	0.39	46.3	1.2	71.5
7. Zn 3rd Cl. Tail.	1.47	0.13	1.13	0.1	0.5
8. Zn 2nd Cl. Tail.	2.92	0.11	0.62	0.2	0.5
9. Zn 1st Cl. Tail.	4.24	0.28	1.42	0.7	1.8
10. Zn Scav. Conc.	6.73	0.09	0.33	0.3	0.7
11. Zn Scav. Tail.	68.08	0.038	0.10	1.5	2.0
Head (Calculated)	100.00	1.73	3.41	100.0	100.0

Calculated Grades and Recoveries

Products 1 and 2	5.23	26.3	4.68	79.4	7.2
Products 1 to 3	5.63	24.6	5.43	80.0	9.0
Products 1 to 4	8.21	17.1	5.82	81.2	14.0
Products 1 to 5	11.29	14.7	6.96	96.0	23.0
Products 6 and 7	6.74	0.33	36.4	1.3	72.0
Products 6 to 8	9.66	0.27	25.6	1.5	72.5
Products 6 to 9	13.90	0.27	18.2	2.2	74.3
Products 6 to 10	20.63	0.21	12.4	2.5	75.0
Products 6 to 11	88.71	0.078	2.96	4.0	77.0

Test No. 1 - Continued

Screen Analyses

Combine Products

Mesh Size (Tyler)	% Retained Individual	% Retained Cumulative	% Passing Cumulative
+ 65	0.4	0.4	99.6
100	2.5	2.9	97.1
150	7.2	10.1	89.9
200	15.2	25.3	74.7
270	18.8	44.1	55.9
400	14.8	58.9	41.1
- 400	41.1	100.0	-
Total	100.0	-	-

Test No. 2

Purpose:	To establish a standard laboratory flotation procedure for Pb-Zn ore Composite 5.
Procedure:	As below.
Feed:	2 kg -10 mesh Composite 5.
Grind:	20 minutes in lab ball mill with 21.7 kg steel balls at 66 % solids.

Conditions:

Stage	Reagents Added, grams per tonne					Time, minutes			pH
	Na_2CO_3	NaCN	343	MIBC	$Ca(OH)_2$	Grind	Cond.	Froth	
Grind	2000	100	15	-	-	20	-	-	-
Pb Ro. 1	-	-	15	12.5	-	-	5	4	9.2
Pb Ro. 2	-	-	5	2.5	-	-	1	3	-
Pb Ro. 3	-	-	5	2.5	-	-	1	3	-
Pb Regrind	500	25	2.5	-	-	10	-	-	-
Pb 1st Cl.	-	-	7.5	5	-	-	1	6	9.6
Pb 2nd Cl.	-	25	2.5	2.5	-	-	1	5	9.6
Pb 3rd Cl.	-	-	-	2.5	100	-	1	4	10.7
Pb 4th Cl.	-	-	-	2.5	50	-	1	3	10.6

Stage	Pb Regrind
Flotation Cell	Rod Mill
Speed: r.p.m.	13.6 kg steel rods

Test No. 2 - Continued

Conditions:

Stage	Reagents Added, grams per tonne				Time, minutes			pH
	$Ca(OH)_2$	$CuSO_4$	343	DF1012	Grind	Cond.	Froth	
Zn Condition	1000	-	-	-	-	5	-	-
	-	350	-	-	-	5	-	11.1
Zn Ro. 1	-	-	25	10	-	1	4	-
Zn Ro. 2	-	-	10	2.5	-	1	4	-
Zn Ro. 3	-	-	10	2.5	-	1	4	-
Zn Regrind	500	100	-	-	10	-	-	-
Zn 1st Cl.	-	-	5	2.5	-	1	10	11.5
Zn 2nd Cl.	100	-	2.5	1.0	-	1	8	11.6
Zn 3rd Cl.	100	-	-	1.0	-	1	6	11.7
Zn 4th Cl.	100	-	-	1.0	-	1	5	11.7

Stage	Zn Regrind
Flotation Cell	Pebble Mill
Speed: r.p.m.	4.5 kg Flint Pebbles

Test No. 2 - Continued

Metallurgical Results

Product	Weight %	Assays, %		% Distribution	
		Pb	Zn	Pb	Zn
1. Pb Cleaner Conc.	6.46	59.7	5.58	75.9	5.4
2. Pb 4th Cl. Tail.	1.55	23.9	9.46	7.3	2.2
3. Pb 3rd Cl. Tail.	1.11	14.3	9.71	3.1	1.6
4. Pb 2nd Cl. Tail.	2.30	7.11	9.99	3.2	3.5
5. Pb 1st Cl. Tail.	8.20	2.33	8.82	3.8	10.9
6. Zn Cleaner Conc.	5.68	0.38	54.1	0.4	46.3
7. Zn 4th Cl. Tail.	1.25	0.66	42.6	0.2	8.0
8. Zn 3rd Cl. Tail.	1.06	0.91	33.4	0.2	5.3
9. Zn 2nd Cl. Tail.	1.16	1.33	11.6	0.3	2.0
10. Zn 1st Cl. Tail.	8.08	0.72	10.4	1.1	12.7
11. Zn Rougher Tail.	63.15	0.36	0.22	4.5	2.1
Head (Calculated)	100.00	5.08	6.64	100.0	100.0

Calculated Grades and Recoveries

Products 1 and 2	8.01	52.8	6.33	83.2	7.6
Products 1 to 3	9.12	48.1	6.74	86.3	9.2
Products 1 to 4	11.42	39.8	7.40	89.5	12.7
Products 1 to 5	19.62	24.2	7.99	93.3	23.6
Products 6 and 7	6.93	0.43	52.0	0.6	54.3
Products 6 to 8	7.99	0.49	49.6	0.8	59.6
Products 6 to 9	9.15	0.60	44.7	1.1	61.6
Products 6 to 10	17.23	0.66	28.6	2.2	74.3
Products 6 to 11	80.38	0.42	6.31	6.7	76.4

Test No. 2 - Continued

Screen Analyses

Zn Rougher Tailing

Mesh Size (Tyler)	% Retained Individual	% Retained Cumulative	% Passing Cumulative
+ 65	0.4	0.4	99.6
100	3.3	3.7	96.3
150	11.0	14.7	85.3
200	18.7	33.4	66.6
270	18.1	51.5	48.5
400	14.4	65.9	34.1
- 400	34.1	100.0	-
Total	100.0	-	-

Test No. 3

Purpose: To repeat test No. 1, but with a coarser grind, include scavenger concentrate in copper cleaning and reduce collector to Zn circuit.

Procedure: As below.

Feed: 2000 grams minus 10 mesh Composite No. 1.

Grind: 22.5 minutes in lab ball mill at 65 % solids.

Conditions:

Stage	Reagents Added, grams per tonne							Time, minutes			pH
	NH_4-OH	NaCN	R350	Pine Oil	SO_2	R343	MIBC	Grind	Cond.	Froth	
Grind	150	35	-	-	-	-	-	22.5	-	-	-
Condition	-	25	-	-	-	-	-	-	2	-	9.2
Aeration	-	-	-	-	-	-	-	-	10	-	-
Cu Rougher	-	-	4	10	-	-	-	-	10	2	8.9
	-	-	2	-	-	-	-	-	1	2	-
	-	-	2	10	-	-	-	-	1	3	-
Cu Cl. Cond.	-	-	-	-	1200	-	-	-	15	-	4.5
Cu 1st Cl.	-	-	-	-	-	-	2	-	1	2	-
	-	-	-	-	-	5	2	-	1	2	-
Cu 2nd Cl.	-	-	-	-	50	-	-	-	2	3	4.5
Cu 3rd Cl.	-	-	-	-	40	-	2	-	2	2	4.5
Combine Cu rougher and 1st cleaner tailings for zinc flotation.											

Test No. 3 - Continued

Conditions:

Stage	Reagents Added, grams per tonne					Time, minutes			pH
	NH_4OH	$CuSO_4$	R343	Pine Oil	MIBC	Grind	Cond.	Froth	
Zn Ro. Cond.	100	200	-	-	-	-	10	-	9.2
Zn Rougher	-	-	15	10	-	-	1	3	-
Zn Scavenger	-	-	10	-	-	-	1	2	-
Clean Zn rougher concentrate									
Zn 1st Cl.	100	-	-	-	2	-	1	2	10.3
Zn 2nd Cl.	100	-	-	-	-	-	1	1.5	10.5
Zn 3rd Cl.	100	-	-	-	-	-	1	1	10.6

Metallurgical Results

Product	Weight %	Assays, %		% Distribution	
		Cu	Zn	Cu	Zn
1. Cu Cleaner Conc.	6.02	23.4	4.99	80.4	8.7
2. Cu 3rd Cl. Tail.	0.54	8.13	21.0	2.5	3.3
3. Cu 2nd Cl. Tail.	1.42	8.44	14.1	6.8	5.8
4. Zn Cleaner Conc.	4.41	1.27	56.0	3.2	71.7
5. Zn 3rd Cl. Tail.	0.08	3.87	36.4	0.2	0.8
6. Zn 2nd Cl. Tail.	0.24	3.54	25.5	0.5	1.8
7. Zn 1st Cl. Tail.	1.54	1.38	5.91	1.2	2.6
8. Zn Scav. Conc.	16.13	0.25	0.43	2.3	2.0
9. Zn Scav. Tail.	69.62	0.073	0.16	2.9	3.3
Head (Calculated)	100.00	1.75	3.45	100.0	100.0

Calculated Grades and Recoveries

Products 1 and 2	6.56	22.1	6.31	82.9	12.0
Products 1 to 3	7.98	19.7	7.69	89.7	17.8
Products 4 and 5	4.49	1.32	55.7	3.4	72.5
Products 4 to 6	4.73	1.43	54.1	3.9	74.3
Products 4 to 7	6.27	1.42	42.3	5.1	76.9
Products 4 to 8	22.40	0.58	12.1	7.4	78.9
Products 4 to 9	92.02	0.20	3.08	10.3	82.2
Products 8 and 9	85.75	0.11	0.21	5.2	5.3

Test No. 3 - Continued

Screen Analyses

Combine Products

Mesh Size (Tyler)	% Retained		% Passing
	Individual	Cumulative	Cumulative
+ 35	0.1	0.1	99.9
48	0.1	0.2	99.8
65	1.4	1.6	98.4
100	7.1	8.7	91.3
150	14.9	23.6	76.4
200	17.5	41.1	58.9
270	15.5	56.6	43.4
400	10.7	67.3	32.7
- 400	32.7	100.0	-
Total	100.0	-	-

Test No. 4

Purpose: To establish a standard laboratory flotation procedure for Cu-Pb-Zn ore Composite No. 4.

Procedure: As below.

Feed: 2 kg -10 mesh Composite 4.

Grind: 40 minutes in lab ball mill at 66 % solids.

Conditions:

Stage	Reagents Added, g/tonne					Time, minutes			pH
	Na_2CO_3	SO_2	R241	343/* 350	MIBC	Grind	Cond.	Froth	
Grind	1500	150	-	-	-	40	-	-	-
Aeration	400	-	-	-	-	-	30	-	9.0
Cu-Pb Ro.	250	-	25	25	8	-	1	5	9.2
Cu-Pb Scav.	300	-	10	-	2	-	1	3	9.6
Regr. Ro.+Scav.	500	-	-	-	-	30**	-	-	9.6
Cu-Pb 1st Cl.	-	-	-	5	5	-	1	6	9.6
Cu-Pb 2nd Cl.	150	-	-	2	2	-	1	5	9.6
Cu-Pb 3rd Cl.	100	-	-	-	2	-	1	4	9.6

* 4/1 ratio 343/350

** 20 g/min in PM

Test No. 4 - Continued

Conditions:

Stage	Reagents Added, grams per tonne				Time, minutes			pH
	$Ca(OH)_2$	$CuSO_4$	343/* 350	MIBC	Grind	Cond.	Froth	
Zn Ro. Cond.	400	600	-	-	-	10	-	9.8
Zn Rougher	-	-	50	10	-	2	5	9.8
Zn Scavenger	200	-	25	2	-	2	3	10.0
Regr. Ro.+Scav.	350	50	-	-	25**	-	-	-
Zn 1st Cl.	-	-	10	5	-	1	6	10.2
Zn 2nd Cl.	100	-	4	2	-	2	4	10.4
Zn 3rd Cl.	100	-	2	2	-	2	3.5	10.6
Zn 4th Cl.	100	-	-	2	-	2	3	10.8

* 4/1 ratio 343/350
** 20 g/min in PM

Conditions:

Stage	Reagents Added, grams per tonne					Time, minutes			pH
	9524	Nuchar WA	SO_2	2030	MIBC	Grind	Cond.	Froth	
Condition 1	250	250	-	-	-	-	20	-	-
Condition 2	-	-	1200	-	-	-	20	-	4.8
Condition 3	-	-	-	8	-	-	2	-	-
Cu-Pb Sep'n	-	-	-	-	-	-	-	3	-
	-	-	-	2	2	-	1	1	-
Cu 1st Cl.	-	-	40	2	-	-	1	3	4.5
Cu 2nd Cl.	-	-	30	-	2	-	1	2.5	4.2
Cu 3rd Cl.	-	-	30	-	2	-	1	2	4.0

Test No. 4 - Continued

Metallurgical Results

Product	Weight %	Assays, %			% Distribution		
		Cu	Pb	Zn	Cu	Pb	Zn
1. Cu Cleaner Conc.	1.31	15.7	6.52	5.75	59.7	2.6	0.9
2. Cu 3rd Cl. Tail.	0.26	4.17	20.2	10.7	3.1	1.6	0.3
3. Cu 2nd Cl. Tail.	0.43	1.44	22.7	10.0	1.8	3.0	0.5
4. Cu 1st Cl. Tail.	0.87	0.67	22.8	9.63	1.7	6.1	1.0
5. Cu-Pb Sep'n Tail.	9.68	0.18	17.1	9.29	5.0	50.9	10.4
6. Cu-Pb 3rd Cl. Tail.	2.64	0.37	5.41	10.6	2.8	4.4	3.2
7. Cu-Pb 2nd Cl. Tail.	3.82	0.25	4.13	10.4	2.8	4.8	4.6
8. Cu-Pb 1st Cl. Tail.	8.26	0.16	3.03	10.6	3.8	7.7	10.2
9. Zn Cleaner Conc.	9.83	0.22	0.68	53.1	6.3	2.1	60.6
10. Zn 4th Cl. Tail.	1.27	0.23	2.45	19.6	0.8	1.0	2.9
11. Zn 3rd Cl. Tail.	1.61	0.20	2.59	9.07	0.9	1.3	1.7
12. Zn 2nd Cl. Tail.	3.27	0.16	1.75	3.35	1.5	1.8	1.3
13. Zn 1st Cl. Tail.	16.48	0.062	0.82	0.57	3.0	4.1	1.1
14. Zn Rougher Tail.	40.27	0.057	0.70	0.28	6.8	8.6	1.3
Head (Calculated)	100.00	0.34	3.25	8.61	100.0	100.0	100.0

Calculated Grades and Recoveries

Products 1 and 2	1.57	13.8	8.78	6.57	62.8	4.2	1.2
Products 1 to 3	2.00	11.1	11.8	7.31	64.6	7.2	1.7
Products 1 to 4	2.87	7.96	15.1	8.01	66.3	13.3	2.7
Products 1 to 5	12.55	1.96	16.6	9.00	71.3	64.2	13.1
Products 1 to 6	15.19	1.68	14.7	9.28	74.1	68.6	16.3
Products 1 to 7	19.01	1.40	12.6	9.50	76.9	73.4	20.9
Products 1 to 8	27.27	1.02	9.68	9.84	80.7	81.1	31.1
Products 9 and 10	11.10	0.22	0.88	49.3	7.1	3.1	63.5
Products 9 to 11	12.71	0.22	1.10	44.2	8.0	4.4	65.2
Products 9 to 12	15.98	0.21	1.23	35.8	9.5	6.2	66.5
Products 9 to 13	32.46	0.13	1.02	17.9	12.5	10.3	67.6
Products 9 to 14	72.73	0.09	0.84	8.16	19.3	18.9	68.9

Test No. 5

Purpose: To repeat test No. 2, but increase Zn recovery by including Pb 1st cleaner tailing in Zn circuit, and increasing collector to Zn cleaners.

Procedure: As below.

Feed: 2000 grams minus 10 mesh Composite No. 5.

Grind: 20 minutes at 65 % solids in the laboratory ball mill.

Conditions:

Stage	Reagents Added, grams per tonne					Time, minutes			pH
	Na_2CO_3	NaCN	343	MIBC	$Ca(OH)_2$	Grind	Cond.	Froth	
Prim. Grind	2000	100	15	-	-	20	-	-	-
Pb Rougher	-	-	15	12.5	-	-	5	4	9.2
	-	-	5	2.5	-	-	1	3	-
	-	-	5	2.5	-	-	1	3	-
Pb Regrind	500	25	5.0	-	-	10	-	-	-
Pb 1st Cl.	-	-	2.5	2.5	-	-	1	3	9.5
	-	-	2.5	2.5	-	-	1	4	-
Pb 2nd Cl.	-	25	-	-	-	-	2	3	9.5
	-	-	2.5	2.5	-	-	1	2	-
Pb 3rd Cl.	-	-	-	-	100	-	1	2	10.6
	-	-	-	2.5	-	-	1	2	-
Pb 4th Cl.	-	-	-	2.5	50	-	1	3	10.6
Combine Pb rougher and 1st cleaner tailings for zinc flotation.									

Test No. 5 - Continued

Conditions:

Stage	Reagents Added, g/tonne				Time, minutes			pH
	$Ca(OH)_2$	$CuSO_4$	343	DF1012	Grind	Cond.	Froth	
Condition	1000	-	-	-	-	5	-	-
	-	350	-	-	-	5	-	11.2
Zn Rougher	-	-	25	10	-	1	4	-
	-	-	10	2.5	-	1	4	-
	-	-	10	2.5	-	1	4	-
Zn Conc. Regr.	500	100	5	-	15	-	-	-
Zn 1st Cl.	-	-	5	2.5	-	1	5	11.5
	-	-	5	2.5	-	1	5	-
Zn 2nd Cl.	100	-	-	-	-	1	4	11.7
	-	-	5	1.0	-	1	4	-
Zn 3rd Cl.	100	-	-	-	-	1	3	11.8
	-	-	2.5	1.0	-	1	3	-
Zn 4th Cl.	150	-	-	1.0	-	1	5	11.8

Metallurgical Results

Product	Weight %	Assays, %		% Distribution	
		Pb	Zn	Pb	Zn
1. Pb Cleaner Conc.	6.25	64.5	5.55	79.4	5.3
2. Pb 4th Cl. Tail.	1.60	24.4	10.1	7.7	2.5
3. Pb 3rd Cl. Tail.	0.63	11.4	14.6	1.4	1.4
4. Pb 2nd Cl. Tail.	1.79	5.69	17.3	2.0	4.7
5. Zn Cleaner Conc.	7.05	0.62	49.2	0.9	52.6
6. Zn 4th Cl. Tail.	0.61	2.26	22.9	0.3	2.1
7. Zn 3rd Cl. Tail.	0.78	2.49	10.3	0.4	1.2
8. Zn 2nd Cl. Tail.	1.32	1.90	3.11	0.5	0.6
9. Zn 1st Cl. Tail.	3.99	0.98	0.98	0.8	0.6
10. Zn Rougher Tail.	75.98	0.45	2.52	6.6	29.0
Head (Calculated)	100.00	5.08	6.59	100.0	100.0

Calculated Grades and Recoveries

Products 1 and 2	7.85	56.3	6.48	87.1	7.8
Products 1 to 3	8.48	53.0	7.08	88.5	9.2
Products 1 to 4	10.27	44.7	8.86	90.5	13.9
Products 5 and 6	7.66	0.75	47.1	1.2	54.7
Products 5 to 7	8.44	0.91	43.7	1.6	55.9
Products 5 to 8	9.76	1.05	38.2	2.1	56.5
Products 5 to 9	13.75	1.03	27.4	2.9	57.1
Products 5 to 10	89.73	0.54	6.33	9.5	86.1

Test No. 6

Purpose:	To repeat test No. 5, but increase $CuSO_4$ addition to Zn rougher.
Procedure:	As below.
Feed:	2000 grams minus 10 mesh Composite No. 5.
Grind:	20 minutes at 65 % solids in the laboratory ball mill.

Conditions:

Stage	Reagents Added, grams per tonne					Time, minutes			pH
	Na_2CO_3	NaCN	343	MIBC	$Ca(OH)_2$	Grind	Cond.	Froth	
Primary Grind	2000	100	15	-	-	20	-	-	-
Pb Rougher	-	-	15	12.5	-	-	5	4	9.2
	-	-	5	2.5	-	-	1	3	-
	-	-	5	2.5	-	-	1	3	-
Pb Conc. Regr.	500	25	5	-	-	10	-	-	-
Pb 1st Cl.	-	-	2.5	2.5	-	-	1	3	9.4
	-	-	5.0	2.5	-	-	1	4	-
Pb 2nd Cl.	-	25	-	-	-	-	2	3	9.4
	-	-	2.5	2.5	-	-	1	2	-
Pb 3rd Cl.	-	-	-	-	100	-	1	2	10.5
	-	-	-	2.5	-	-	1	2	-
Pb 4th Cl.	-	-	2.5	2.5	50	-	1	3	10.6

Combine Pb rougher and 1st cleaner tailings for zinc flotation

Test No. 6 - Continued

Conditions:

Stage	Reagents Added, g/tonne				Time, minutes			pH
	$Ca(OH)_2$	$CuSO_4$	343	DF1012	Grind	Cond.	Froth	
Zn Condition	1000	-	-	-	-	5	-	-
	-	500	-	-	-	5	-	-
Zn Rougher	-	-	25	10	-	1	4	11.0
	-	-	10	2.5	-	1	4	-
	-	-	10	2.5	-	1	4	-
Zn Conc. Regr.	500	100	5	-	15	-	-	-
Zn 1st Cl.	-	-	5	2.5	-	1	5	11.4
	-	-	5	2.5	-	1	5	-
Zn 2nd Cl.	100	-	-	-	-	1	4	11.5
	-	-	5	1.0	-	1	4	-
Zn 3rd Cl.	100	-	-	-	-	1	3	11.6
	-	-	2.5	1.0	-	1	3	-
Zn 4th Cl.	150	-	-	1.0	-	1	5	11.8

Test No. 6 - Continued

Metallurgical Results

Product	Weight	Assays, %		% Distribution	
	%	Pb	Zn	Pb	Zn
1. Pb Cleaner Conc.	8.76	51.3	6.94	87.4	9.0
2. Pb 4th Cl. Tail.	0.69	13.5	6.91	1.8	0.7
3. Pb 3rd Cl. Tail.	0.80	6.71	9.19	1.0	1.1
4. Pb 2nd Cl. Tail.	2.61	4.04	10.4	2.0	4.1
5. Zn Cleaner Conc.	8.73	0.39	53.3	0.7	69.1
6. Zn 4th Cl. Tail.	1.27	1.22	31.9	0.3	6.0
7. Zn 3rd Cl. Tail.	1.19	2.45	6.33	0.5	1.1
8. Zn 2nd Cl. Tail.	1.57	1.52	1.65	0.5	0.4
9. Zn 1st Cl. Tail.	5.11	0.78	0.43	0.8	0.3
10. Zn Rougher Tail.	69.27	0.37	0.79	5.0	8.2
Head (Calculated)	100.00	5.15	6.73	100.0	100.0

Calculated Grades and Recoveries

Products 1 and 2	9.45	48.5	6.94	89.2	9.7
Products 1 to 3	10.25	45.3	7.11	90.2	10.8
Products 1 to 4	12.86	36.9	7.78	92.2	14.9
Products 5 and 6	10.00	0.50	50.6	1.0	75.1
Products 5 to 7	11.19	0.70	45.9	1.5	76.2
Products 5 to 8	12.76	0.80	40.4	2.0	76.6
Products 5 to 9	17.87	0.80	29.0	2.8	76.9
Products 5 to 10	87.14	0.46	6.57	7.8	85.1

Test No. 7

Purpose: To investigate the stage flotation of copper-lead from Composite No. 4.

Procedure: As below.

Feed: 2000 grams minus 10 mesh Composite No. 4.

Grind: 40 minutes at 66 percent solids in the lab ball mill.

Conditions:

Stage	Reagents Added, grams per tonne					Time, minutes			pH
	Na_2CO_3	SO_2	343/350	241	MIBC	Grind	Cond.	Froth	
Grind	1500	150	-	-	-	40	-	-	8.3
Aeration	350	-	-	-	-	-	30	-	9.0
Cu-Pb Conc. No. 1	100	-	10	10	10	-	1	2	9.0
Cu-Pb Conc. No. 2	150	-	10	10	-	-	1	2	9.2
Cu-Pb Conc. No. 3	150	-	10	10	-	-	1	2	9.4
Cu-Pb Conc. No. 4	200	-	10	10	-	-	1	2	9.6

Test No. 7 - Continued

Metallurgical Results

Product	Weight %	Assays, %			% Distribution		
		Cu	Pb	Zn	Cu	Pb	Zn
1. Cu-Pb Conc. No. 1	10.10	2.39	15.8	7.62	68.4	47.4	8.7
2. Cu-Pb Conc. No. 2	10.30	0.46	9.79	11.1	13.4	30.0	13.0
3. Cu-Pb Conc. No. 3	5.91	0.30	2.99	10.7	5.0	5.3	7.2
4. Cu-Pb Conc. No. 4	5.97	0.18	1.93	9.45	3.0	3.4	6.4
5. Cu-Pb Flot. Tail.	67.72	0.053	0.69	8.44	10.2	13.9	64.7
Head (Calculated)	100.00	0.35	3.36	8.83	100.0	100.0	100.0

Calculated Grades and Recoveries

Products 1 and 2	20.40	1.42	12.8	9.38	81.8	77.4	21.7
Products 1 to 3	26.31	1.16	10.6	9.67	86.8	82.7	28.9
Products 1 to 4	32.28	0.98	8.97	9.63	89.8	86.1	35.3

Screen Analyses

Combine Products

Mesh Size (Tyler)	% Retained Individual	% Retained Cumulative	% Passing Cumulative
+ 150	0.4	0.4	99.6
200	2.0	2.4	97.6
270	5.9	8.3	91.7
400	10.0	18.3	81.7
- 400	81.7	100.0	-
Total	100.0	-	-

Test No. 8

Purpose: To repeat test No. 7, but omit Na_2CO_3 from the grind.

Procedure: As below.

Feed: 2000 grams minus 10 mesh Composite No. 4.

Grind: 40 minutes at 66 % solids in the lab ball mill.

Conditions:

Stage	Reagents Added, grams per tonne					Time, minutes			pH
	Na_2-CO_3	SO_2	343/350	241	MIBC	Grind	Cond.	Froth	
Grind	-	150	-	-	-	40	-	-	7.9
Aeration	1100	-	-	-	-	-	30	-	9.0
Cu-Pb Conc. No. 1	200	-	10	10	10	-	1	2	9.0
Cu-Pb Conc. No. 2	150	-	10	10	-	-	1	2	9.2
Cu-Pb Conc. No. 3	200	-	10	10	-	-	1	2	9.4
Cu-Pb Conc. No. 4	250	-	10	10	-	-	1	2	9.6

Metallurgical Results

Product	Weight	Assays, %			% Distribution		
	%	Cu	Pb	Zn	Cu	Pb	Zn
1. Cu-Pb Conc. No. 1	7.20	2.82	14.1	6.85	59.7	30.5	5.9
2. Cu-Pb Conc. No. 2	7.91	0.68	16.4	10.2	15.8	38.9	9.7
3. Cu-Pb Conc. No. 3	7.37	0.41	4.65	10.6	8.9	10.3	9.4
4. Cu-Pb Conc. No. 4	5.36	0.25	2.57	9.86	3.9	4.1	6.3
5. Cu-Pb Flot. Tail.	72.16	0.055	0.75	7.95	11.7	16.2	68.7
Head (Calculated)	100.00	0.34	3.33	8.35	100.0	100.0	100.0

Calculated Grades and Recoveries

Products 1 and 2	15.11	1.70	15.3	8.60	75.5	69.4	15.6
Products 1 to 3	22.48	1.28	11.8	9.26	84.4	79.7	25.0
Products 1 to 4	27.84	1.08	10.0	9.37	88.3	83.8	31.3

Test No. 9

Purpose: To repeat test No. 8, but double the SO_2 addition to the grind.

Procedure: As below.

Feed: 2000 grams minus 10 mesh Composite No. 4.

Grind: 40 minutes at 66 % solids in the lab ball mill.

Conditions:

Stage	Reagents Added, grams per tonne					Time, minutes			pH
	Na_2CO_3	SO_2	343/350	241	MIBC	Grind	Cond.	Froth	
Grind	-	300	-	-	-	40	-	-	7.8
Aeration	2000	-	-	-	-	-	30	-	9.2
Cu-Pb Conc. No. 1	350	-	10	10	10	-	1	2	9.0
Cu-Pb Conc. No. 2	200	-	10	10	-	-	1	2	9.2
Cu-Pb Conc. No. 3	200	-	10	10	-	-	1	2	9.4
Cu-Pb Conc. No. 4	200	-	10	10	-	-	1	2	9.6

Metallurgical Results

Product	Weight %	Assays, %			% Distribution		
		Cu	Pb	Zn	Cu	Pb	Zn
1. Cu-Pb Conc. No. 1	6.38	3.18	14.6	6.77	59.6	27.7	5.1
2. Cu-Pb Conc. No. 2	10.04	0.60	14.6	9.80	17.7	43.6	11.7
3. Cu-Pb Conc. No. 3	6.51	0.40	4.44	10.7	7.6	8.6	8.3
4. Cu-Pb Conc. No. 4	4.81	0.27	2.62	9.61	3.8	3.7	5.5
5. Cu-Pb Flot. Tail.	72.26	0.053	0.76	8.12	11.3	16.4	69.4
Head (Calculated)	100.00	0.34	3.36	8.44	100.0	100.0	100.0

Calculated Grades and Recoveries

Products 1 and 2	16.42	1.60	14.6	8.62	77.3	71.3	16.8
Products 1 to 3	22.93	1.26	11.7	9.21	84.9	79.9	25.1
Products 1 to 4	27.74	1.09	10.1	9.28	88.7	83.6	30.6

Test No. 10

Purpose: To repeat tests No. 8 and 9, but again increase the SO_2 addition to the grind.

Procedure: As below.

Feed: 2000 grams minus 10 mesh Composite No. 4.

Grind: 40 minutes at 66 % solids in the lab ball mill.

Conditions:

Stage	Reagents Added, grams per tonne					Time, minutes			pH
	Na_2-CO_3	SO_2	343/350	241	MIBC	Grind	Cond.	Froth	
Grind	-	600	-	-	-	40	-	-	7.6
Aeration	2750	-	-	-	-	-	30	-	9.2
Cu-Pb Conc. No. 1	400	-	10	10	10	-	1	2	9.0
Cu-Pb Conc. No. 2	200	-	10	10	-	-	1	2	9.2
Cu-Pb Conc. No. 3	200	-	10	10	-	-	1	2	9.4
Cu-Pb Conc. No. 4	250	-	10	10	-	-	1	2	9.6

Metallurgical Results

Product	Weight %	Assays, %			% Distribution		
		Cu	Pb	Zn	Cu	Pb	Zn
1. Cu-Pb Conc. No. 1	6.98	2.93	20.1	6.67	60.0	41.6	5.5
2. Cu-Pb Conc. No. 2	10.55	0.62	10.5	10.6	19.2	32.9	13.2
3. Cu-Pb Conc. No. 3	4.81	0.45	3.78	10.5	6.3	5.4	6.0
4. Cu-Pb Conc. No. 4	3.67	0.32	2.77	9.73	3.4	3.0	4.2
5. Cu-Pb Flot. Tail.	73.99	0.051	0.78	8.14	11.1	17.1	71.1
Head (Calculated)	100.00	0.34	3.37	8.47	100.0	100.0	100.0

Calculated Grades and Recoveries

Products 1 and 2	17.53	1.54	14.3	9.04	79.2	74.5	18.7
Products 1 to 3	22.34	1.30	12.1	9.35	85.5	79.9	24.7
Products 1 to 4	26.01	1.17	10.7	9.40	88.9	82.9	28.9

Test No. 11

Purpose: To repeat test No. 6, but reduce NaCN and add $ZnSO_4$.

Procedure: As in previous tests, but no zinc cleaners.

Feed: 2000 grams minus 10 mesh Composite No. 5.

Grind: 20 minutes at 65 % solids in the laboratory ball mill.

Conditions:

Stage	Reagents Added, grams per tonne								Time, minutes			pH
	Na_2-CO_3	Zn-SO_4	NaCN	343	MIBC	Ca-$(OH)_2$	Cu-SO_4	DF-1012	Grind	Cond.	Froth	
Prim. Grind	2000	75	25	15	-	-	-	-	20	-	-	-
Pb Rougher	-	-	-	15	12.5	-	-	-	-	5	4	9.0
	-	-	-	5	2.5	-	-	-	-	1	3	-
	-	-	-	5	2.5	-	-	-	-	1	3	-
Pb Conc. Regr.	500	19	6	5	-	-	-	-	10	-	-	-
Pb 1st Cl.	-	-	-	2.5	2.5	-	-	-	-	1	3	9.4
	-	-	-	2.5	2.5	-	-	-	-	1	4	-
Pb 2nd Cl.	-	19	6	-	-	-	-	-	-	2	3	9.3
	-	-	-	2.5	2.5	-	-	-	-	1	2	-
Pb 3rd Cl.	-	-	-	-	2.5	100	-	-	-	1	4	10.4
Pb 4th Cl.	-	-	-	-	2.5	50	-	-	-	1	3	10.5
Combine Pb rougher and 1st cleaner tailings												
Condition	-	-	-	-	-	1000	-	-	-	5	-	-
	-	-	-	-	-	-	500	-	-	5	-	11.2
Zn Rougher	-	-	-	25	-	-	-	10	-	1	4	-
	-	-	-	10	-	-	-	2.5	-	1	4	-
	-	-	-	10	-	-	-	2.5	-	1	4	-

Test No. 11 - Continued

Metallurgical Results

Product	Weight %	Assays, % Pb	Assays, % Zn	% Distribution Pb	% Distribution Zn
1. Pb Cleaner Conc.	6.87	56.4	6.25	77.1	6.5
2. Pb 4th Cl. Tail.	0.85	22.1	7.89	3.7	1.0
3. Pb 3rd Cl. Tail.	1.39	13.6	8.58	3.8	1.8
4. Pb 2nd Cl. Tail.	2.97	5.81	8.46	3.4	3.8
5. Zn Rougher Conc.	40.46	0.64	11.9	5.2	73.1
6. Zn Rougher Tail.	47.46	0.72	1.90	6.8	13.8
Head (Calculated)	100.00	5.02	6.58	100.0	100.0

Calculated Grades and Recoveries

Products 1 and 2	7.72	52.7	6.43	80.8	7.5
Products 1 to 3	9.11	46.7	6.76	84.6	9.3
Products 1 to 4	12.08	36.6	7.18	88.0	13.1
Products 5 and 6	87.92	0.68	6.50	12.0	86.9

Test No. 12

Purpose: The first in a series of rougher flotation tests to evaluate various depressant combinations. In this test use depressant LS-1 (1:1 of LS-H:$ZnSO_4$).

Procedure: As below.

Feed: 2000 grams minus 10 mesh Composite No. 5.

Grind: 20 minutes at 65 % solids in the lab ball mill.

Conditions:

Stage	Reagents Added, grams per tonne							Time, minutes			pH
	Na_2-CO_3	LS-1	343	MIBC	Ca-$(OH)_2$	$CuSO_4$	DF1012	Grind	Cond.	Froth	
Grind	2000	150	15	-	-	-	-	20	-	-	-
Pb Rougher	-	-	15	12.5	-	-	-	-	5	4	9.0
	-	-	5	2.5	-	-	-	-	1	3	-
	-	-	5	2.5	-	-	-	-	1	3	-
Condition	-	-	-	-	750	-	-	-	5	-	-
	-	-	-	-	-	500	-	-	5	-	10.5
Zn Rougher	-	-	25	-	-	-	10	-	1	4	-
	-	-	10	-	-	-	2.5	-	1	4	-
	-	-	10	-	-	-	2.5	-	1	4	-

Metallurgical Results

Product	Weight %	Assays, %		% Distribution	
		Pb	Zn	Pb	Zn
1. Pb Ro. Conc.	6.88	21.1	8.89	27.4	9.2
2. Zn Ro. Conc.	17.85	7.91	24.2	26.7	65.1
3. Zn Ro. Tail.	75.27	3.23	2.26	45.9	25.7
Head (Calc.)	100.00	5.29	6.63	100.0	100.0

Calculated Grades and Recoveries

Products 2 and 3	93.12	4.12	6.46	72.6	90.7

Test No. 13

Purpose: To repeat test No. 12, but reduce the LS-1 addition by one-half to 75 g/t.

Procedure: As below.

Feed: 2000 grams minus 10 mesh Composite No. 5.

Grind: 20 minutes at 65 % solids in the lab ball mill.

Conditions:

Stage	Reagents Added, grams per tonne							Time, minutes			pH
	Na_2-CO_3	LS-1	343	MIBC	Ca-$(OH)_2$	$CuSO_4$	DF1012	Grind	Cond.	Froth	
Grind	2000	75	15	-	-	-	-	20	-	-	-
Pb Rougher	-	-	15	12.5	-	-	-	-	5	4	9.1
	-	-	5	2.5	-	-	-	-	1	3	-
	-	-	5	2.5	-	-	-	-	1	3	-
Condition	-	-	-	-	750	-	-	-	5	-	-
	-	-	-	-	-	500	-	-	5	-	10.6
Zn Rougher	-	-	25	-	-	-	10	-	1	4	-
	-	-	10	-	-	-	2.5	-	1	4	-
	-	-	10	-	-	-	2.5	-	1	4	-

Metallurgical Results

Product	Weight	Assays, %		% Distribution	
	%	Pb	Zn	Pb	Zn
1. Pb Rougher Conc.	5.77	17.0	9.05	18.7	7.8
2. Zn Rougher Conc.	14.19	10.5	28.3	28.4	59.7
3. Zn Rougher Tail.	80.04	3.46	2.73	52.9	32.5
Head (Calculated)	100.00	5.24	6.72	100.0	100.0

Calculated Grades and Recoveries

Products 2 and 3	94.23	4.52	6.58	81.3	92.2

Test No. 14

Purpose: To continue the series of rougher evaluation tests using depressant LS-2 (1:1:1 of LS-H, $ZnSO_4$, XD21).

Procedure: As below.

Feed: 2000 grams minus 10 mesh Composite No. 5.

Grind: 20 minutes at 65 % solids in the lab ball mill.

Conditions:

Stage	Reagents Added, grams per tonne							Time, minutes			pH
	Na_2CO_3	LS-2	343	MIBC	$Ca(OH)_2$	$CuSO_4$	DF1012	Grind	Cond.	Froth	
Grind	2000	75	15	-	-	-	-	20	-	-	-
Pb Rougher	-	-	15	12.5	-	-	-	-	5	4	9.0
	-	-	5	2.5	-	-	-	-	1	3	-
	-	-	5	2.5	-	-	-	-	1	3	-
Condition	-	-	-	-	750	-	-	-	5	-	-
	-	-	-	-	-	500	-	-	5	-	-
Zn Rougher	-	-	25	-	-	-	10	-	1	4	10.5
	-	-	10	-	-	-	2.5	-	1	4	-
	-	-	10	-	-	-	2.5	-	1	4	-

Metallurgical Results

Product	Weight	Assays, %		% Distribution	
	%	Pb	Zn	Pb	Zn
1. Pb Rougher Conc.	5.97	17.5	9.99	19.9	9.1
2. Zn Rougher Conc.	17.85	11.8	26.9	40.2	73.2
3. Zn Rougher Tail.	76.18	2.75	1.53	39.9	17.7
Head (Calculated)	100.00	5.25	6.56	100.0	100.0

Calculated Grades and Recoveries

Products 2 and 3	94.03	4.47	6.35	80.1	90.9

Test No. 15

Purpose: To continue the series of rougher evaluation tests using depressant LS-3 (1:1:1 of LS-H, $ZnSO_4$, 1902).

Procedure: As below.

Feed: 2000 grams minus 10 mesh Composite No. 5.

Grind: 20 minutes at 65 % solids in the lab ball mill.

Conditions:

Stage	Reagents Added, grams per tonne							Time, minutes			pH
	Na_2-CO_3	LS-3	343	MIBC	Ca-$(OH)_2$	$CuSO_4$	DF1012	Grind	Cond.	Froth	
Grind	2000	75	15	-	-	-	-	20	-	-	-
Pb Rougher	-	-	15	12.5	-	-	-	-	5	4	9.1
	-	-	5	2.5	-	-	-	-	1	3	-
	-	-	5	2.5	-	-	-	-	1	3	-
Condition	-	-	-	-	750	-	-	-	5	-	-
	-	-	-	-	-	500	-	-	5	-	10.6
Zn Rougher	-	-	25	-	-	-	10	-	1	4	-
	-	-	10	-	-	-	2.5	-	1	4	-
	-	-	10	-	-	-	2.5	-	1	4	-

Metallurgical Results

Product	Weight %	Assays, %		% Distribution	
		Pb	Zn	Pb	Zn
1. Pb Rougher Conc.	7.45	19.7	9.08	27.9	10.1
2. Zn Rougher Conc.	19.75	9.70	25.8	36.5	76.0
3. Zn Rougher Tail.	72.80	2.57	1.28	35.6	13.9
Head (Calculated)	100.00	5.25	6.70	100.0	100.0

Calculated Grades and Recoveries

Products 2 and 3	92.55	4.09	6.51	72.1	89.9

Test No. 16

Purpose:	To repeat the previous tests, but use NaCN in place of the LS depressant.
Procedure:	As below.
Feed:	2000 grams minus 10 mesh Composite No. 5.
Grind:	20 minutes at 65 % solids in the laboratory ball mill.

Conditions:

Stage	Reagents Added, grams per tonne							Time, minutes			pH
	Na_2-CO_3	NaCN	343	MIBC	Ca-$(OH)_2$	$CuSO_4$	DF1012	Grind	Cond.	Froth	
Grind	2000	75	15	-	-	-	-	20	-	-	-
Pb Rougher	-	-	15	12.5	-	-	-	-	5	4	9.1
	-	-	5	2.5	-	-	-	-	1	3	-
	-	-	5	2.5	-	-	-	-	1	3	-
Condition	-	-	-	-	750	-	-	-	5	-	-
	-	-	-	-	-	500	-	-	5	-	10.6
Zn Rougher	-	-	25	-	-	-	10	-	1	4	-
	-	-	10	-	-	-	2.5	-	1	4	-
	-	-	10	-	-	-	2.5	-	1	4	-

Metallurgical Results

Product	Weight %	Assays, %		% Distribution	
		Pb	Zn	Pb	Zn
1. Pb Rougher Conc.	20.96	24.3	7.60	94.0	24.4
2. Zn Rougher Conc.	60.76	0.35	8.00	3.9	74.4
3. Zn Rougher Tails.	18.28	0.63	0.42	2.1	1.2
Head (Calculated)	100.00	5.42	6.53	100.0	100.0

Calculated Grades and Recoveries

Products 2 and 3	79.04	0.41	6.25	6.0	75.6

Test No. 17

Purpose: To repeat the previous tests with no depressant added.

Procedure: As below.

Feed: 2000 grams minus 10 mesh Composite No. 5.

Grind: 20 minutes at 65 % solids in the laboratory ball mill.

Conditions:

Stage	Reagents Added, grams per tonne						Time, minutes			pH
	Na_2CO_3	343	MIBC	$Ca(OH)_2$	$CuSO_4$	1012	Grind	Cond.	Froth	
Grind	2000	15	-	-	-	-	20	-	-	-
Pb Rougher	-	15	12.5	-	-	-	-	5	4	9.0
	-	5	2.5	-	-	-	-	1	3	-
	-	5	2.5	-	-	-	-	1	3	-
Condition	-	-	-	750	-	-	-	5	-	-
	-	-	-	-	500	-	-	5	-	10.5
Zn Rougher	-	25	-	-	-	10	-	1	4	-
	-	10	-	-	-	2.5	-	1	4	-
	-	10	-	-	-	2.5	-	1	4	-

Metallurgical Results

Product	Weight %	Assays, %		% Distribution	
		Pb	Zn	Pb	Zn
1. Pb Rougher Conc.	10.96	24.7	8.72	50.0	14.6
2. Zn Rougher Conc.	40.51	4.16	13.0	31.1	80.4
3. Zn Rougher Tail.	48.53	2.10	0.67	18.9	5.0
Head (Calculated)	100.00	5.41	6.55	100.0	100.0

Calculated Grades and Recoveries

Products 2 and 3	89.04	3.03	6.28	50.0	85.4

Test No. 18

Purpose: The first in a series of tests to investigate rougher flotation on Composite No. 1, using various depressants.

Procedure: Grind, aerate and float a copper rougher concentrate and a zinc rougher concentrate.

Feed: 2000 grams minus 10 mesh Composite No. 1.

Grind: 23 minutes at 65 % solids in laboratory ball mill.

Conditions:

Stage	Reagents Added, grams per tonne						Time, minutes			pH
	NH_4OH	NaCN	R350	Pine Oil	$CuSO_4$	R343	Grind	Cond.	Froth	
Grind	150	35	-	-	-	-	23	-	-	-
Condition	-	25	-	-	-	-	-	2	-	9.2
Aeration	-	-	-	-	-	-	-	10	-	-
Cu Rougher	-	-	4	10	-	-	-	10	2	8.9
	-	-	2	2.5	-	-	-	1	2	-
	-	-	2	2.5	-	-	-	1	3	-
Condition	100	-	-	-	200	-	-	10	-	9.4
Zn Rougher	-	-	-	10	-	15	-	1	3	-
	-	-	-	2.5	-	10	-	1	2	-

Metallurgical Results

Product	Weight %	Assays, %		% Distribution	
		Cu	Zn	Cu	Zn
1. Cu Rougher Conc.	10.75	14.3	6.56	86.3	20.6
2. Zn Rougher Conc.	25.04	0.83	10.5	11.7	76.6
3. Zn Rougher Tail.	64.21	0.055	0.15	2.0	2.8
Head (Calculated)	100.00	1.78	3.43	100.0	100.0

Calculated Grades and Recoveries

Products 2 and 3	89.25	0.27	3.05	13.7	79.4

Test No. 19

Purpose: To repeat test No. 18, but replace NaCN with depressant LS-1.

Procedure: As for test No. 18.

Feed: 2000 grams minus 10 mesh Composite No. 1.

Grind: 23 minutes at 65 % solids in the lab ball mill.

Conditions:

Stage	Reagents Added, grams per tonne						Time, minutes			pH
	NH_4OH	LS-1	R350	Pine Oil	$CuSO_4$	R343	Grind	Cond.	Froth	
Grind	150	50	-	-	-	-	23	-	-	-
Condition	-	25	-	-	-	-	-	2	-	9.0
Aeration	-	-	-	-	-	-	-	10	-	-
Cu Rougher	-	-	4	10	-	-	-	10	2	8.8
	-	-	2	2.5	-	-	-	1	2	-
	-	-	2	2.5	-	-	-	1	3	-
Condition	100	-	-	-	200	-	-	10	-	9.2
Zn Rougher	-	-	-	10	-	15	-	1	3	-
	-	-	-	2.5	-	10	-	1	2	-

Metallurgical Results

Product	Weight %	Assays, %		% Distribution	
		Cu	Zn	Cu	Zn
1. Cu Rougher Conc.	25.49	6.64	5.92	95.4	42.1
2. Zn Rougher Conc.	9.33	0.36	21.2	1.9	55.2
3. Zn Rougher Tail.	65.18	0.073	0.15	2.7	2.7
Head (Calculated)	100.00	1.77	3.58	100.0	100.0

Calculated Grades and Recoveries

Products 2 and 3	74.51	0.10	2.78	4.6	57.9

Test No. 20

Purpose: To repeat test No. 18, but replace NaCN with depressant LS-2.

Procedure: As for test No. 18.

Feed: 2000 grams minus 10 mesh Composite No. 1.

Grind: 23 minutes at 65 % solids in the lab ball mill.

Conditions:

Stage	Reagents Added, grams per tonne						Time, minutes			pH
	NH_4OH	LS-2	R350	Pine Oil	$CuSO_4$	R343	Grind	Cond.	Froth	
Grind	150	50	-	-	-	-	23	-	-	-
Condition	-	25	-	-	-	-	-	2	-	8.9
Aeration	-	-	-	-	-	-	-	10	-	-
Cu Rougher	-	-	4	10	-	-	-	10	2	8.7
	-	-	2	2.5	-	-	-	1	2	-
	-	-	2	2.5	-	-	-	1	3	-
Condition	100	-	-	-	200	-	-	10	-	9.4
Zn Rougher	-	-	-	10	-	15	-	1	3	-
	-	-	-	2.5	-	10	-	1	2	-

Metallurgical Results

Product	Weight %	Assays, %		% Distribution	
		Cu	Zn	Cu	Zn
1. Cu Rougher Conc.	28.40	6.05	6.36	95.6	50.5
2. Zn Rougher Conc.	8.31	0.43	20.2	2.0	46.9
3. Zn Rougher Tail.	63.29	0.068	0.15	2.4	2.6
Head (Calculated)	100.00	1.80	3.58	100.0	100.0

Calculated Grades and Recoveries

Products 2 and 3	71.6	0.10	2.48	4.4	49.5

Test No. 21

Purpose:	To repeat test No. 18, but replace NaCN with depressant LS-3.
Procedure:	As for test No. 18.
Feed:	2000 grams minus 10 mesh Composite No. 1.
Grind:	23 minutes at 65 % solids in the lab ball mill.

Conditions:

Stage	Reagents Added, grams per tonne						Time, minutes			pH
	NH_4OH	LS-3	R350	Pine Oil	$CuSO_4$	R343	Grind	Cond.	Froth	
Grind	150	50	-	-	-	-	23	-	-	-
Condition	-	25	-	-	-	-	-	2	-	8.9
Aeration	-	-	-	-	-	-	-	10	-	-
Cu Rougher	-	-	4	10	-	-	-	10	2	8.7
	-	-	2	2.5	-	-	-	1	2	-
	-	-	2	2.5	-	-	-	1	3	-
Condition	100	-	-	-	200	-	-	10	-	9.3
Zn Rougher	-	-	-	10	-	15	-	1	3	-
	-	-	-	2.5	-	10	-	1	2	-

Metallurgical Results

Product	Weight %	Assays, %		% Distribution	
		Cu	Zn	Cu	Zn
1. Cu Rougher Conc.	27.88	5.97	6.04	95.2	47.9
2. Zn Rougher Conc.	8.57	0.45	20.3	2.2	49.4
3. Zn Rougher Tail.	63.55	0.070	0.15	2.6	2.7
Head (Calculated)	100.00	1.75	3.52	100.0	100.0

Calculated Grades and Recoveries

Products 2 and 3	72.12	0.11	2.54	4.8	52.1

Test No. 22

Purpose:	To investigate the effect of adding depressant LS-1 on rougher flotation of Composite No. 4.
Procedure:	As below.
Feed:	2000 grams minus 10 mesh Composite No. 4.
Grind:	40 minutes at 66 % solids in the lab ball mill.

Conditions:

Stage	Reagents Added, grams per tonne						Time, minutes			pH
	Na_2-CO_3	SO_2	LS-1	343/350	241	MIBC	Grind	Cond.	Froth	
Grind	-	300	150	-	-	-	-	-	-	7.9
Aeration	2500	-	-	-	-	-	-	30	-	9.2
Cu-Pb Conc. No. 1	400	-	-	10	10	10	-	1	2	9.0
Cu-Pb Conc. No. 2	250	-	-	10	10	-	-	1	2	9.2
Cu-Pb Conc. No. 3	250	-	-	10	10	-	-	1	2	9.4
Cu-Pb Conc. No. 4	300	-	-	10	10	-	-	1	2	9.6

Metallurgical Results

Product	Weight %	Assays, %			% Distribution		
		Cu	Pb	Zn	Cu	Pb	Zn
1. Cu-Pb Conc. No. 1	11.54	2.15	16.4	7.97	72.9	56.6	10.7
2. Cu-Pb Conc. No. 2	9.36	0.38	6.71	11.6	10.5	18.8	12.7
3. Cu-Pb Conc. No. 3	6.75	0.23	2.75	10.2	4.6	5.5	8.0
4. Cu-Pb Conc. No. 4	4.18	0.17	2.09	9.44	2.0	2.6	4.6
5. Cu-Pb Flot. Tail.	68.17	0.050	0.81	8.03	10.0	16.5	64.0
Head (Calculated)	100.00	0.34	3.35	8.56	100.0	100.0	100.0

Calculated Grades and Recoveries

Products 1 and 2	20.90	1.36	12.1	9.60	83.4	75.4	23.4
Products 1 to 3	27.65	1.08	9.79	9.74	88.0	80.9	31.4
Products 1 to 4	31.83	0.96	8.78	9.70	90.0	83.5	36.0

Test No. 23

Purpose: To repeat test No. 22, but replace depressant LS-1 with LS-2.

Procedure: As below.

Feed: 2000 grams minus 10 mesh Composite No. 4.

Grind: 40 minutes at 66 % solids in the lab ball mill.

Conditions:

Stage	Reagents Added, grams per tonne						Time, minutes			pH
	Na_2-CO_3	SO_2	LS-2	343/350	241	MIBC	Grind	Cond.	Froth	
Grind	-	300	150	-	-	-	40	-	-	-
Aeration	2500	-	-	-	-	-	-	30	-	9.2
Cu-Pb Conc. No. 1	400	-	-	10	10	10	-	1	2	9.0
Cu-Pb Conc. No. 2	200	-	-	10	10	-	-	1	2	9.2
Cu-Pb Conc. No. 3	250	-	-	10	10	-	-	1	2	9.4
Cu-Pb Conc. No. 4	300	-	-	10	10	-	-	1	2	9.6

Metallurgical Results

Product	Weight %	Assays, %			% Distribution		
		Cu	Pb	Zn	Cu	Pb	Zn
1. Cu-Pb Conc. No. 1	11.68	2.13	17.0	8.08	72.1	59.3	11.0
2. Cu-Pb Conc. No. 2	9.51	0.40	5.78	10.8	11.0	16.4	11.9
3. Cu-Pb Conc. No. 3	5.98	0.24	2.75	10.1	4.2	4.9	7.0
4. Cu-Pb Conc. No. 4	7.66	0.15	1.69	8.58	3.3	3.9	7.6
5. Cu-Pb Flot. Tail.	65.17	0.050	0.80	8.24	9.4	15.5	62.5
Head (Calculated)	100.00	0.35	3.35	8.60	100.0	100.0	100.0

Calculated Grades and Recoveries

Products 1 and 2	21.19	1.35	12.0	9.30	83.1	75.7	22.9
Products 1 to 3	27.17	1.11	9.94	9.48	87.3	80.6	29.9
Products 1 to 4	34.83	0.90	8.12	9.28	90.6	84.5	37.5

Test No. 24

Purpose: To repeat test No. 22, but replace depressant LS-1 with LS-3.

Procedure: As below.

Feed: 2000 grams minus 10 mesh Composite No. 4.

Grind: 40 minutes at 66 % solids in the lab ball mill.

Conditions:

Stage	Reagents Added, grams per tonne						Time, minutes			pH
	Na_2CO_3	SO_2	LS-3	343/350	241	MIBC	Grind	Cond.	Froth	
Grind	-	300	150	-	-	-	40	-	-	-
Aeration	2500	-	-	-	-	-	-	30	-	9.2
Cu-Pb Conc. No. 1	400	-	-	10	10	10	-	1	2	9.0
Cu-Pb Conc. No. 2	200	-	-	10	10	-	-	1	2	9.2
Cu-Pb Conc. No. 3	250	-	-	10	10	-	-	1	2	9.4
Cu-Pb Conc. No. 4	250	-	-	10	10	-	-	1	2	9.6

Metallurgical Results

Product	Weight %	Assays, %			% Distribution		
		Cu	Pb	Zn	Cu	Pb	Zn
1. Cu-Pb Conc. No. 1	11.52	2.17	17.5	7.81	71.6	60.1	10.5
2. Cu-Pb Conc. No. 2	10.20	0.40	5.81	11.1	11.7	17.7	13.2
3. Cu-Pb Conc. No. 3	5.03	0.23	2.55	10.0	3.3	3.8	5.8
4. Cu-Pb Conc. No. 4	6.79	0.14	1.54	7.97	2.7	3.1	6.3
5. Cu-Pb Flot. Tail.	66.46	0.056	0.77	8.32	10.7	15.3	64.2
Head (Calculated)	100.00	0.35	3.35	8.61	100.0	100.0	100.0

Calculated Grades and Recoveries

Products 1 and 2	21.72	1.34	12.0	9.35	83.3	77.8	23.7
Products 1 to 3	26.75	1.13	10.2	9.48	86.6	81.6	29.5
Products 1 to 4	33.54	0.93	8.47	9.17	89.3	84.7	35.8

Test No. 25

Purpose: To repeat test No. 18, but add 50 g/t SO_2 to the grind and float only three separate copper concentrates.

Procedure: Grind, aerate and float three copper concentrates.

Feed: 2000 grams minus 10 mesh Composite No. 1.

Grind: 23 minutes az 65 % solids in the lab ball mill.

Conditions:

Stage	Reagents Added, g/tonne					Time, minutes			pH
	NH_4OH*	SO_2*	NaCN	R350	Pine Oil	Grind	Cond.	Froth	
Grind	150	50	60	-	-	23	-	-	-
Aeration	-	-	-	-	-	-	10	-	8.2
	50	-	-	-	-	-	-	-	-
Cu Conc. No. 1	-	-	-	4	10	-	5	2	8.5
Cu Conc. No. 2	-	-	-	2	2.5	-	1	2	-
Cu Conc. No. 3	-	-	-	2	2.5	-	1	3	-

* NH_4OH and SO_2 combined before adding to mill

Metallurgical Results

Product	Weight %	Assays, %		% Distribution	
		Cu	Zn	Cu	Zn
1. Cu Conc. No. 1	5.91	21.8	8.02	70.1	13.0
2. Cu Conc. No. 2	4.45	10.3	10.1	24.9	12.3
3. Cu Conc. No. 3	3.12	1.29	11.8	2.2	10.1
4. Cu Flot. Tail.	86.52	0.059	2.72	2.8	64.6
Head (Calculated)	100.00	1.84	3.65	100.0	100.0

Calculated Grades and Recoveries

Products 1 and 2	10.36	16.9	8.91	95.0	25.3
Products 1 to 3	13.48	13.3	9.58	97.2	35.4

Test No. 26

Purpose: To repeat test No. 25, but substitute 150 g/t depressant LS-3 for NaCN, and reduce collector addition.

Procedure: As for test No. 25.

Feed: 2000 grams minus 10 mesh Composite No. 1.

Grind: 23 minutes at 65 % solids in the lab ball mill.

Conditions:

Stage	Reagents Added, grams per tonne					Time, minutes			pH
	NH_4OH	SO_2	LS-3	R350	Pine Oil	Grind	Cond.	Froth	
Grind	150	50	150	-	-	23	-	-	-
Aeration	50	-	-	-	-	-	10	-	8.5
Cu Conc. No. 1	-	-	-	2.5	10	-	5	2	-
Cu Conc. No. 2	-	-	-	1.3	2.5	-	1	2	-
Cu Conc. No. 3	-	-	-	1.2	2.5	-	1	3	-

Metallurgical Results

Product	Weight %	Assays, %		% Distribution	
		Cu	Zn	Cu	Zn
1. Cu Conc. No. 1	7.26	20.7	9.72	82.0	19.4
2. Cu Conc. No. 2	3.91	5.74	11.3	12.2	12.1
3. Cu Conc. No. 3	4.86	0.68	7.50	1.8	10.0
4. Cu Flot. Tail.	83.97	0.087	2.53	4.0	58.5
Head (Calculated)	100.00	1.83	3.63	100.0	100.0

Calculated Grades and Recoveries

Products 1 and 2	11.17	15.5	10.3	94.2	31.5
Products 1 to 3	16.03	11.0	9.43	96.0	41.5

Test No. 27

Purpose:	To repeat test No. 25, but substitute 150 g/t depressant LS-1 for NaCN.
Procedure:	As for test No. 25.
Feed:	2000 grams minus 10 mesh Composite No. 1.
Grind:	23 minutes at 65 % solids in the lab ball mill.

Conditions:

Stage	Reagents Added, g/tonne					Time, minutes			pH
	NH_4OH	SO_2	LS-1	R350	Pine Oil	Grind	Cond.	Froth	
Grind	150	50	150	-	-	23	-	-	-
Aeration	50	-	-	-	-	-	10	-	8.5
Cu Conc. No. 1	-	-	-	2.5	10	-	5	2	-
Cu Conc. No. 2	-	-	-	1.3	2.5	-	1	2	-
Cu Conc. No. 3	-	-	-	1.2	2.5	-	1	3	-

Metallurgical Results

Product	Weight %	Assays, %		% Distribution	
		Cu	Zn	Cu	Zn
1. Cu Conc. No. 1	11.13	13.7	5.49	86.6	16.8
2. Cu Conc. No. 2	5.34	2.66	7.35	8.1	10.8
3. Cu Conc. No. 3	6.30	0.52	6.13	1.9	10.6
4. Cu Flot. Tail.	77.23	0.079	2.90	3.4	61.8
Head (Calculated)	100.00	1.76	3.63	100.0	100.0

Calculated Grades and Recoveries

Products 1 and 2	16.47	10.1	6.09	94.7	27.6
Products 1 to 3	22.77	7.46	6.10	96.6	38.2

Test No. 28

Purpose: To repeat test No. 25, but substitute 150 g/t depressant LS-2 for NaCN.

Procedure: As for test No. 25.

Feed: 2000 grams minus 10 mesh Composite No. 1.

Grind: 23 minutes at 65 % solids in the lab ball mill.

Conditions:

Stage	Reagents Added, g/tonne					Time, minutes			pH
	NH_4OH	SO_2	LS-2	R350	Pine Oil	Grind	Cond.	Froth	
Grind	150	50	150	-	-	23	-	-	-
Aeration	50	-	-	-	-	-	10	-	8.5
Cu Conc. No. 1	-	-	-	2.5	10	-	5	2	-
Cu Conc. No. 2	-	-	-	1.3	2.5	-	1	2	-
Cu Conc. No. 3	-	-	-	1.2	2.5	-	1	3	-

Metallurgical Results

Product	Weight	Assays, %		% Distribution	
	%	Cu	Zn	Cu	Zn
1. Cu Conc. No. 1	12.73	12.1	5.31	88.6	18.8
2. Cu Conc. No. 2	7.15	1.65	7.47	6.8	14.8
3. Cu Conc. No. 3	6.91	0.39	5.78	1.6	11.1
4. Cu Flot. Tail.	73.21	0.072	2.72	3.0	55.3
Head (Calculated)	100.00	1.74	3.60	100.0	100.0

Calculated Grades and Recoveries

Products 1 and 2	19.88	8.34	6.09	95.4	33.6
Products 1 to 3	26.79	6.28	6.01	97.0	44.7

Test No. 29

Purpose: To repeat test No. 25, but with no depressant added.

Procedure: As for test No. 25.

Feed: 2000 grams minus 10 mesh Composite No. 1.

Grind: 23 minutes at 65 % solids in the lab ball mill.

Conditions:

Stage	Reagents Aded, g/tonne				Time, minutes			pH
	NH_4OH	SO_2	R350	Pine Oil	Grind	Cond.	Froth	
Grind	150	50	-	-	23	-	-	-
Aeration	50	-	-	-	-	10	-	8.5
Cu Conc. No. 1	-	-	2.5	10	-	5	2	-
Cu Conc. No. 2	-	-	1.3	2.5	-	1	2	-
Cu Conc. No. 3	-	-	1.2	2.5	-	1	3	-

Metallurgical Results

Product	Weight %	Assays, %		% Distribution	
		Cu	Zn	Cu	Zn
1. Cu Conc. No. 1	10.61	15.1	10.3	90.9	31.1
2. Cu Conc. No. 2	9.01	0.94	6.20	4.8	15.9
3. Cu Conc. No. 3	5.85	0.38	5.51	1.3	9.2
4. Cu Flot. Tail.	74.53	0.071	2.07	3.0	43.8
Head (Calculated)	100.00	1.76	3.52	100.0	100.0

Calculated Grades and Recoveries

Products 1 and 2	19.62	8.60	8.42	95.7	47.0
Products 1 to 3	25.47	6.71	7.75	97.0	56.2

Test No. 30

Purpose: To investigate the effect of Depressant LS-4 on the flotation of copper and depression of zinc and pyrite from Composite No. 1.

Procedure: As for test No. 25.

Feed: 2000 grams minus 10 mesh Composite No. 1.

Grind: 23 minutes at 65 % solids in the lab ball mill.

Conditions:

Stage	Reagents Added, g/tonne				Time, minutes			pH
	NH_4OH	LS-4	R350	Pine Oil	Grind	Cond.	Froth	
Grind	150	150	-	-	23	-	-	-
Aeration	25	-	-	-	-	10	-	8.5
Cu Conc. No. 1	-	-	2.5	10	-	5	2	-
Cu Conc. No. 2	-	-	1.3	2.5	-	1	2	-
Cu Conc. No. 3	-	-	1.2	2.5	-	1	3	-

Metallurgical Results

Product	Weight %	Assays, %		% Distribution	
		Cu	Zn	Cu	Zn
1. Cu Conc. No. 1	11.62	13.3	6.68	89.7	21.8
2. Cu Conc. No. 2	10.15	0.94	5.74	5.5	16.4
3. Cu Conc. No. 3	6.61	0.40	5.95	1.5	11.1
4. Cu Flot. Tail.	71.62	0.079	2.52	3.3	50.7
Head (Calculated)	100.00	1.72	3.56	100.0	100.0

Calculated Grades and Recoveries

Products 1 and 2	21.77	7.54	6.24	95.2	38.2
Products 1 to 3	28.38	5.87	6.17	96.7	49.3

Test No. 31

Purpose: To repeat test No. 30, but replace depressant LS-4 with depressant LS-5.

Procedure: As for test No. 25.

Feed: 2000 grams minus 10 mesh Composite No. 1.

Grind: 23 minutes at 65 % solids in the lab ball mill.

Conditions:

Stage	Reagents Added, g/tonne				Time, minutes			pH
	NH_4OH	LS-5	R350	Pine Oil	Grind	Cond.	Froth	
Grind	150	150	-	-	23	-	-	-
Aeration	20	-	-	-	-	10	-	8.5
Cu Conc. No. 1	-	-	2.5	10	-	5	2	-
Cu Conc. No. 2	-	-	1.3	2.5	-	1	2	-
Cu Conc. No. 3	-	-	1.2	2.5	-	1	3	-

Metallurgical Results

Product	Weight %	Assays, %		% Distribution	
		Cu	Zn	Cu	Zn
1. Cu Conc. No. 1	14.17	10.9	6.16	90.0	24.5
2. Cu Conc. No. 2	9.50	0.93	6.43	5.2	17.1
3. Cu Conc. No. 3	6.04	0.45	6.22	1.6	10.5
4. Cu Flot. Tail.	70.29	0.079	2.43	3.2	47.9
Head (Calculated)	100.00	1.72	3.57	100.0	100.0

Calculated Grades and Recoveries

Products 1 and 2	23.67	6.90	6.27	95.2	41.6
Products 1 to 3	29.71	5.59	6.26	96.8	52.1

Test No. 32

Purpose: To repeat test No. 30, but replace depressant LS-4 with depressant LS-6.

Procedure: As for test No. 25.

Feed: 2000 grams minus 10 mesh Composite No. 1.

Grind: 23 minutes at 65 % solids in the lab ball mill.

Conditions:

Stage	Reagents Added, g/tonne				Time, minutes			pH
	NH_4OH	LS-6	R350	Pine Oil	Grind	Cond.	Froth	
Grind	150	150	-	-	23	-	-	-
Aeration	-	-	-	-	-	10	-	8.5
Cu Conc. No. 1	-	-	2.5	10	-	5	2	-
Cu Conc. No. 2	-	-	1.3	2.5	-	1	2	-
Cu Conc. No. 3	-	-	1.2	2.5	-	1	3	-

Metallurgical Results

Product	Weight %	Assays, %		% Distribution	
		Cu	Zn	Cu	Zn
1. Cu Conc. No. 1	11.34	13.3	6.39	86.9	20.2
2. Cu Conc. No. 2	11.69	1.12	4.46	7.5	14.5
3. Cu Conc. No. 3	6.53	0.48	6.63	1.8	12.1
4. Cu Flot. Tail.	70.44	0.093	2.71	3.8	53.2
Head (Calculated)	100.00	1.74	3.59	100.0	100.0

Calculated Grades and Recoveries

Products 1 and 2	23.03	7.11	5.41	94.4	34.7
Products 1 to 3	29.56	5.65	5.68	96.2	46.8

Test No. 33

Purpose: To perform a reproducibility test using the copper rougher conditions of test No. 25 and clean as in test No. 3.

Procedure: As below.

Feed: 2000 grams minus 10 mesh Composite No. 1.

Grind: 23 minutes at 65 % solids in the lab ball mill.

Conditions:

Stage	Reagents Added, grams per tonne							Time, minutes			pH
	NH_4-OH	SO_2	NaCN	R350	Pine Oil	R343	MIBC	Grind	Cond.	Froth	
Grind	150	50	60	-	-	-	-	23	-	-	-
Aeration	100	-	-	-	-	-	-	-	10	-	9.2
Cu Rougher	-	-	-	4	10	-	-	-	1	2	-
	-	-	-	2	2.5	-	-	-	1	2	-
	-	-	-	2	2.5	-	-	-	1	3	-
Cu Cl. Cond.	-	1100	-	-	-	-	-	-	15	-	4.5
Cu 1st Cl.	-	-	-	-	-	-	2	-	1	2	-
	-	-	-	-	-	5	2	-	1	2	-
Cu 2nd Cl.	-	60	-	-	-	-	-	-	2	3	4.5
Cu 3rd Cl.	-	50	-	-	-	-	2	-	2	2	4.5

Combine Cu rougher and 1st cleaner tailings for zinc flotation.

Test No. 33 - Continued

Conditions:

Stage	Reagents Added, grams per tonne					Time, minutes			pH
	NH_4-OH	$CuSO_4$	R343	Pine Oil	MIBC	Grind	Cond.	Froth	
Zn Condition	100	200	-	-	-	-	10	-	9.4
Zn Rougher	-	-	15	10	-	-	1	3	-
Zn Scavenger	-	-	10	-	-	-	1	2	-
Zn Ro. 1st Cl.	100	-	-	-	2	-	1	2	10.0
Zn 2nd Cl.	100	-	-	-	2	-	1	1.5	10.2
Zn 3rd Cl.	100	-	-	-	2	-	1	1	10.3

Metallurgical Results

Product	Weight %	Assays, %		% Distribution	
		Cu	Zn	Cu	Zn
1. Cu Cleaner Conc.	7.33	22.5	6.81	92.5	13.8
2. Cu 3rd Cl. Tail.	0.80	4.02	25.7	1.8	5.7
3. Cu 2nd Cl. Tail.	1.20	1.87	25.5	1.3	8.5
4. Zn Cleaner Conc.	4.25	0.36	55.9	0.9	65.9
5. Zn 3rd Cl. Tail.	0.20	1.01	12.0	0.1	0.7
6. Zn 2nd Cl. Tail.	0.36	1.05	5.82	0.2	0.6
7. Zn 1st Cl. Tail.	3.19	0.39	1.45	0.7	1.3
8. Zn Scav. Conc.	15.55	0.098	0.27	0.8	1.2
9. Zn Scav. Tail.	67.12	0.045	0.13	1.7	2.3
Head (Calculated)	100.00	1.78	3.61	100.0	100.0

Calculated Grades and Recoveries

Products 1 and 2	8.13	20.7	8.67	94.3	19.5
Products 1 to 3	9.33	18.3	10.8	95.6	28.0
Products 4 and 5	4.45	0.39	53.9	1.0	66.6
Products 4 to 6	4.81	0.44	50.3	1.2	67.2
Products 4 to 7	8.00	0.42	30.8	1.9	68.5
Products 4 to 8	23.55	0.21	10.7	2.7	69.7
Products 4 to 9	90.67	0.087	2.86	4.4	72.0
Products 8 and 9	82.67	0.055	0.16	2.5	3.5

Test No. 34

Purpose: To repeat test No. 25, but add zinc rougher and scavenger.

Procedure: Grind, aerate and float three copper concentrates, condition the copper tailing and float zinc rougher and scavenger concentrates.

Feed: 2000 grams minus 10 mesh Composite No. 1.

Grind: 23 minutes at 65 % solids in the lab ball mill.

Conditions:

Stage	Reagents Added, grams per tonne							Time, minutes			pH
	NH_4-OH	SO_2	NaCN	R350	Pine Oil	$CuSO_4$	R343	Grind	Cond.	Froth	
Grind	150	50	60	-	-	-	-	23	-	-	-
Aeration	50	-	-	-	-	-	-	-	10	-	8.5
Cu Conc. No. 1	-	-	-	4	10	-	-	-	5	2	-
Cu Conc. No. 2	-	-	-	2	2.5	-	-	-	1	2	-
Cu Conc. No. 3	-	-	-	2	2.5	-	-	-	1	3	-
Condition	100	-	-	-	-	200	-	-	10	-	9.5
Zn Rougher	-	-	-	-	10	-	15	-	1	3	-
Zn Scavenger	-	-	-	-	-	-	10	-	1	2	-

Test No. 34 - Continued

Metallurgical Results

Product	Weight %	Assays, %		% Distribution	
		Cu	Zn	Cu	Zn
1. Cu Conc. No. 1	5.71	17.1	7.08	54.0	11.4
2. Cu Conc. No. 2	3.92	12.3	7.90	26.7	8.7
3. Cu Conc. No. 3	3.34	7.79	9.13	14.4	8.6
4. Zn Ro. Conc.	6.93	0.59	34.6	2.3	67.4
5. Zn Scav. Conc.	17.04	0.12	0.30	1.1	1.4
6. Zn Scav. Tail.	63.06	0.042	0.14	1.5	2.5
Head (Calculated)	100.00	1.81	3.56	100.0	100.0

Calculated Grades and Recoveries

Products 1 and 2	9.63	15.2	7.41	80.7	20.1
Products 1 to 3	12.97	13.3	7.86	95.1	28.7
Products 4 and 5	23.97	0.26	10.2	3.4	68.8
Products 4 to 6	87.03	0.10	2.92	4.9	71.3

Test No. 35

Purpose: To repeat test No. 26, but add zinc rougher and scavenger.

Procedure: As for test No. 34.

Feed: 2000 grams minus 10 mesh Composite No. 1.

Grind: 23 minutes at 65 % solids in the lab ball mill.

Conditions:

Stage	Reagents Added, grams per tonne							Time, minutes			pH
	NH_4-OH	SO_2	LS-3	R-350	Pine Oil	$CuSO_4$	R343	Grind	Cond.	Froth	
Grind	150	50	150	-	-	-	-	23	-	-	-
Aeration	50	-	-	-	-	-	-	-	10	-	8.5
Cu Conc. No. 1	-	-	-	2.5	10	-	-	-	5	2	-
Cu Conc. No. 2	-	-	-	1.3	2.5	-	-	-	1	2	-
Cu Conc. No. 3	-	-	-	1.2	2.5	-	-	-	1	3	-
Condition	100	-	-	-	-	200	-	-	10	-	9.4
Zn Rougher	-	-	-	-	10	-	15	-	1	3	-
Zn Scavenger	-	-	-	-	-	-	10	-	1	2	-

Metallurgical Results

Product	Weight %	Assays, %		% Distribution	
		Cu	Zn	Cu	Zn
1. Cu Conc. No. 1	13.01	12.1	6.35	89.8	23.2
2. Cu Conc. No. 2	9.00	0.94	5.85	4.8	14.8
3. Cu Conc. No. 3	5.30	0.55	7.01	1.7	10.5
4. Zn Ro. Conc.	7.16	0.30	24.0	1.2	48.4
5. Zn Scav. Conc.	3.33	0.35	0.91	0.7	0.9
6. Zn Scav. Tail.	62.20	0.050	0.13	1.8	2.2
Head (Calculated)	100.00	1.75	3.55	100.0	100.0

Calculated Grades and Recoveries

Products 1 and 2	22.01	7.54	6.15	94.6	38.0
Products 1 to 3	27.31	6.18	6.31	96.3	48.5
Products 4 and 5	10.49	0.32	16.7	1.9	49.3
Products 4 to 6	72.69	0.088	2.52	3.7	51.5

Test No. 36

Purpose: To repeat test No. 26, but use less collector and extend 1st stage flotation time.

Procedure: As for test No. 34.

Feed: 2000 grams minus 10 mesh Composite No. 1.

Grind: 23 minutes at 65 % solids in the lab ball mill.

Conditions:

Stage	Reagents Added, grams per tonne							Time, minutes			pH
	NH_4-OH	SO_2	LS-3	R350	Pine Oil	$CuSO_4$	R343	Grind	Cond.	Froth	
Grind	150	50	150	-	-	-	-	23	-	-	-
Aeration	50	-	-	-	-	-	-	-	10	-	8.5
Cu Conc. No. 1	-	-	-	2.0	-	-	-	-	1	3	-
Cu Conc. No. 2	-	-	-	1.0	-	-	-	-	1	2	-
Cu Conc. No. 3	-	-	-	1.0	-	-	-	-	1	2	-
Condition	100	-	-	-	-	200	-	-	10	-	9.3
Zn Rougher	-	-	-	-	10	-	15	-	1	3	-
Zn Scavenger	-	-	-	-	5	-	10	-	1	2	-

Metallurgical Results

Product	Weight	Assays, %		% Distribution	
	%	Cu	Zn	Cu	Zn
1. Cu Conc. No. 1	10.55	14.7	7.39	87.3	22.2
2. Cu Conc. No. 2	7.44	1.83	6.29	7.7	13.3
3. Cu Conc. No. 3	5.36	0.42	6.36	1.3	9.7
4. Zn Ro. Conc.	11.56	0.21	15.7	1.4	51.7
5. Zn Scav. Conc.	2.73	0.41	0.99	0.6	0.8
6. Zn Scav. Tail.	62.36	0.050	0.13	1.7	2.3
Head (Calculated)	100.00	1.78	3.51	100.0	100.0

Calculated Grades and Recoveries

Products 1 and 2	17.99	9.38	6.93	95.0	35.5
Products 1 to 3	23.35	7.32	6.80	96.3	45.2
Products 4 and 5	14.29	0.25	12.9	2.0	52.5
Products 4 to 6	76.65	0.087	2.51	3.7	54.8

Test No. 37

Purpose: To repeat test No. 16, but add 75 g/t depressant LS-3.

Procedure: Grind and float three lead concentrates. Condition the lead tailing and float a zinc rougher concentrate.

Feed: 2000 grams minus 10 mesh Composite No. 5.

Grind: 20 minutes at 65 % solids in the laboratory ball mill.

Conditions:

Stage	Reagents Added, grams per tonne								Time, minutes			pH
	Na_2CO_3	NaCN	LS-3	343	MIBC	$Ca(OH)_2$	$CuSO_4$	DF-1012	Grind	Cond.	Froth	
Grind	2000	75	75	15	-	-	-	-	20	-	-	-
Pb Conc. No. 1	-	-	-	15	12.5	-	-	-	-	5	4	8.6
Pb Conc. No. 2	-	-	-	5	2.5	-	-	-	-	1	3	-
Pb Conc. No. 3	-	-	-	5	2.5	-	-	-	-	1	3	-
Condition	-	-	-	-	-	750	-	-	-	5	-	-
	-	-	-	-	-	-	500	-	-	5	-	10.0
Zn Rougher	-	-	-	25	-	-	-	10	-	1	4	-
	-	-	-	10	-	-	-	2.5	-	1	4	-

Metallurgical Results

Product	Weight %	Assays, %		% Distribution	
		Pb	Zn	Pb	Zn
1. Pb Conc. No. 1	15.76	28.2	6.39	83.6	15.2
2. Pb Conc. No. 2	4.52	8.00	9.30	6.8	6.3
3. Pb Conc. No. 3	4.05	3.69	7.92	2.8	4.8
4. Zn Ro. Conc.	56.07	0.42	8.54	4.4	72.1
5. Zn Ro. Tail.	19.60	0.65	0.55	2.4	1.6
Head (Calculated)	100.00	5.32	6.64	100.0	100.0

Calculated Grades and Recoveries

Products 1 and 2	20.28	23.7	7.04	90.4	21.5
Products 1 to 3	24.33	20.4	7.19	93.2	26.3
Products 4 and 5	75.67	0.48	6.47	6.8	73.7

Test No. 38

Purpose: To repeat test No. 15, but use depressant LS-6.

Procedure: As for test No. 37.

Feed: 2000 grams minus 10 mesh Composite No. 5.

Grind: 20 minutes at 65 % solids in the laboratory ball mill.

Conditions:

Stage	Reagents Added, grams per tonne							Time, minutes			pH
	Na_2CO_3	LS-6	343	MIBC	$Ca(OH)_2$	$CuSO_4$	DF-1012	Grind	Cond.	Froth	
Grind	2000	75	15	-	-	-	-	20	-	-	-
Pb Conc. No. 1	-	-	15	12.5	-	-	-	-	5	4	8.1
Pb Conc. No. 2	-	-	5	2.5	-	-	-	-	1	3	-
Pb Conc. No. 3	-	-	5	2.5	-	-	-	-	1	3	-
Condition	-	-	-	-	750	-	-	-	5	-	-
	-	-	-	-	-	500	-	-	5	-	9.7
Zn Rougher	-	-	25	-	-	-	10	-	1	4	-
	-	-	10	-	-	-	2.5	-	1	4	-

Metallurgical Results

Product	Weight %	Assays, %		% Distribution	
		Pb	Zn	Pb	Zn
1. Pb Conc. No. 1	4.50	21.0	10.3	17.9	7.1
2. Pb Conc. No. 2	3.78	27.1	7.43	19.4	4.3
3. Pb Conc. No. 3	3.57	24.7	7.45	16.7	4.1
4. Zn Ro. Conc.	44.38	1.83	9.35	15.4	64.0
5. Zn Ro. Tail.	43.77	3.70	3.03	30.6	20.5
Head (Calculated)	100.00	5.28	6.49	100.0	100.0

Calculated Grades and Recoveries

Products 1 and 2	8.28	23.8	8.99	37.3	11.4
Products 1 to 3	11.85	24.1	8.53	54.0	15.5
Products 4 and 5	88.15	2.76	6.21	46.0	84.5

Test No. 39

Purpose: To perform a reproducibility test using the lead circuit conditions of test No. 5 and the zinc circuit conditions of test No. 6.

Procedure: As below.

Feed: 2000 grams minus 10 mesh Composite No. 5.

Grind: 20 minutes at 65 % solids in the laboratory ball mill.

Conditions:

Stage	Reagents Added, g/tonne					Time, minutes			pH
	Na_2CO_3	NaCN	343	MIBC	$Ca(OH)_2$	Grind	Cond.	Froth	
Prim. Grind	2000	100	15	-	-	20	-	-	8.3
Pb Rougher	350	-	15	12.5	-	-	5	4	9.0
	-	-	5	2.5	-	-	1	3	-
	-	-	5	2.5	-	-	1	3	-
Pb Regrind	500	25	5	-	-	10	-	-	-
Pb 1st Cl.	-	-	2.5	2.5	-	-	1	3	9.3
	-	-	2.5	2.5	-	-	1	4	-
Pb 2nd Cl.	-	25	-	-	-	-	2	3	-
	-	-	2.5	2.5	-	-	1	2	-
Pb 3rd Cl.	-	-	-	-	100	-	1	2	10.1
	-	-	-	2.5	-	-	1	2	-
Pb 4th Cl.	-	-	-	2.5	50	-	1	3	10.6

Combine Pb rougher and 1st cleaner tailings for zinc flotation.

Test No. 39 - Continued

Conditions:

Stage	Reagents Added, g/tonne				Time, minutes			pH
	$Ca(OH)_2$	$CuSO_4$	343	DF1012	Grind	Cond.	Froth	
Condition	1000	-	-	-	-	5	-	-
	-	500	-	-	-	5	-	11.0
Zn Rougher	-	-	25	10	-	1	4	-
	-	-	10	2.5	-	1	4	-
Zn Conc. Regr.	500	100	5	-	15	-	-	-
Zn 1st Cl.	-	-	5	2.5	-	1	5	11.4
	-	-	5	2.5	-	1	5	-
Zn 2nd Cl.	100	-	-	-	-	1	4	11.6
	-	-	5	1.0	-	1	4	-
Zn 3rd Cl.	100	-	-	-	-	1	3	11.6
	-	-	2.5	1.0	-	1	3	-
Zn 4th Cl.	150	-	-	1.0	-	1	5	11.8

Test No. 39 - Continued

Metallurgical Results

Product	Weight	Assays, %		% Distribution	
	%	Pb	Zn	Pb	Zn
1. Pb Cleaner Conc.	7.38	56.7	6.45	80.5	7.0
2. Pb 4th Cl. Tail.	2.13	15.0	5.84	6.1	1.8
3. Pb 3rd Cl. Tail.	1.51	6.28	6.60	1.8	1.5
4. Pb 2nd Cl. Tail.	2.34	6.19	10.0	2.8	3.4
5. Zn Cleaner Conc.	9.38	0.52	52.4	0.9	71.8
6. Zn 4th Cl. Tail.	0.56	2.30	16.2	0.2	1.3
7. Zn 3rd Cl. Tail.	0.66	2.28	6.84	0.3	0.7
8. Zn 2nd Cl. Tail.	1.86	1.03	1.41	0.4	0.4
9. Zn 1st Cl. Tail.	20.45	0.32	0.24	1.3	0.7
10. Zn Ro. Tail.	53.73	0.55	1.46	5.7	11.4
Head (Calculated)	100.00	5.20	6.84	100.0	100.0

Calculated Grades and Recoveries

Products 1 and 2	9.51	47.4	6.31	86.6	8.8
Products 1 to 3	11.02	41.7	6.35	88.4	10.3
Products 1 to 4	13.36	35.5	6.99	91.2	13.7
Products 5 and 6	9.94	0.62	50.4	1.1	73.1
Products 5 to 7	10.60	0.72	47.7	1.4	73.8
Products 5 to 8	12.46	0.77	40.7	1.8	74.2
Products 5 to 9	32.91	0.49	15.6	3.1	74.9
Products 5 to 10	86.64	0.53	6.82	8.8	86.3

Test No. 40

Purpose: To establish a grinding time and copper flotation conditions for Composite No. 2 ore.

Procedure: Grind, aerate and float three copper concentrates.

Feed: 2000 grams minus 10 mesh Composite No. 2.

Grind: 25 minutes at 66 % solids in the laboratory ball mill.

Conditions:

Stage	Reagents Added, grams per tonne					Time, minutes			pH
	SO_2	$Ca(OH)_2$	R208	R317	MIBC	Grind	Cond.	Froth	
Primary Grind	-	-	-	-	-	25	-	-	7.2
Aeration	750	-	-	-	-	-	10	-	5.5
Condition	-	1500	-	-	-	-	3	-	10.5
Cu Conc. No. 1	-	-	20	10	10	-	2	4	-
Cu Conc. No. 2	-	-	10	5	2.5	-	1	3	-
Cu Conc. No. 3	-	-	10	5	2.5	-	1	3	-

Stage	Aeration	Flotation
Flotation Cell	1000 g D - 1	1000 g D - 1
Speed: r.p.m.	1800	1800
% Solids	35	33

Test No. 40 - Continued

Metallurgical Results

Product	Weight %	Assays, %		% Distribution	
		Cu	Zn	Cu	Zn
1. Cu Conc. No. 1	16.84	15.4	10.1	95.2	39.6
2. Cu Conc. No. 2	8.60	0.86	16.3	2.7	32.6
3. Cu Conc. No. 3	9.53	0.32	8.91	1.1	19.8
4. Cu Flot. Tail.	65.03	0.039	0.53	1.0	8.0
Head (Calculated)	100.00	2.72	4.30	100.0	100.0

Calculated Grades and Recoveries

Products 1 and 2	25.44	10.5	12.2	97.9	72.2
Products 1 to 3	34.97	7.71	11.3	99.0	92.0

Screen Analyses

Combine Products

Mesh Size (Tyler)	% Retained Individual	Cumulative	% Passing Cumulative
+ 65	0.8	0.8	99.2
100	2.9	3.7	96.3
150	6.0	9.7	90.3
200	10.4	20.1	79.9
270	11.4	31.5	68.5
400	10.7	42.2	57.8
- 400	57.8	100.0	-
Total	100.0	-	-

Test No. 41

Purpose: To repeat test No. 40, but add 150 g/t depressant LS-1 to the grind.

Procedure: As for test No. 40.

Feed: 2000 grams minus 10 mesh Composite No. 2.

Grind: 25 minutes at 66 % solids in the laboratory ball mill.

Conditions:

Stage	Reagents Added, grams per tonne						Time, minutes			pH
	LS-1	SO_2	$Ca(OH)_2$	R208	R317	MIBC	Grind	Cond.	Froth	
Grind	150	-	-	-	-	-	25	-	-	-
Aeration	-	750	-	-	-	-	-	10	-	5.4
Condition	-	-	1500	-	-	-	-	3	-	10.3
Cu Conc. No. 1	-	-	-	20	10	10	-	2	4	-
Cu Conc. No. 2	-	-	-	10	5	2.5	-	1	3	-
Cu Conc. No. 3	-	-	-	10	5	2.5	-	1	3	-

Metallurgical Results

Product	Weight %	Assays, %		% Distribution	
		Cu	Zn	Cu	Zn
1. Cu Conc. No. 1	14.41	17.8	9.29	93.4	30.8
2. Cu Conc. No. 2	8.29	1.30	16.7	3.9	31.8
3. Cu Conc. No. 3	10.82	0.35	9.38	1.4	23.3
4. Cu Flot. Tail.	66.48	0.055	0.92	1.3	14.1
Head (Calculated)	100.00	2.75	4.35	100.0	100.0

Calculated Grades and Recoveries

Products 1 and 2	22.70	11.8	12.0	97.3	62.6
Products 1 to 3	33.52	8.09	11.2	98.7	85.9

Test No. 42

Purpose: To repeat test No. 16, but reduce cyanide addition to 50 g/t.

Procedure: As for test No. 37.

Feed: 2000 grams minus 10 mesh Composite No. 5.

Grind: 20 minutes at 65 % solids in the laboratory ball mill.

Conditions:

Stage	Reagents Added, grams per tonne							Time, minutes			pH
	Na_2CO_3	NaCN	343	MIBC	$Ca(OH)_2$	$CuSO_4$	DF1012	Grind	Cond.	Froth	
Grind	2500	50	15	-	-	-	-	20	-	-	-
Pb Conc. No. 1	-	-	15	12.5	-	-	-	-	5	4	8.8
Pb Conc. No. 2	-	-	5	2.5	-	-	-	-	1	3	-
Pb Conc. No. 3	-	-	5	2.5	-	-	-	-	1	3	-
Condition	-	-	-	-	1000	-	-	-	5	-	-
	-	-	-	-	-	500	-	-	5	-	10.7
Zn Rougher	-	-	25	-	-	-	10	-	1	4	-
	-	-	10	-	-	-	5	-	1	4	-

Test No. 42 - Continued

Metallurgical Results

Product	Weight	Assays, %		% Distribution	
	%	Pb	Zn	Pb	Zn
1. Pb Conc. No. 1	15.22	30.9	7.22	89.4	16.4
2. Pb Conc. No. 2	2.88	5.34	8.93	2.9	3.8
3. Pb Conc. No. 3	2.92	2.99	7.95	1.7	3.5
4. Zn Ro. Conc.	19.43	0.64	25.5	2.4	73.9
5. Zn Ro. Tail.	59.55	0.32	0.27	3.6	2.4
Head (Calculated)	100.00	5.26	6.70	100.0	100.0

Calculated Grades and Recoveries

Products 1 and 2	18.10	26.8	7.49	92.3	20.2
Products 1 to 3	21.02	23.5	7.56	94.0	23.7
Products 4 and 5	78.98	0.40	6.48	6.0	76.3

Test No. 43

Purpose: To repeat test No. 42, but add 75 g/t of depressant LS-3.

Procedure: As for test No. 37.

Feed: 2000 grams minus 10 mesh Composite No. 5.

Grind: 20 minutes at 65 % solids in the laboratory ball mill.

Conditions:

Stage	Reagents Added, grams per tonne								Time, minutes			pH
	Na_2CO_3	NaCN	LS-3	343	MIBC	$Ca(OH)_2$	$CuSO_4$	DF-1012	Grind	Cond.	Froth	
Grind	2500	50	75	15	-	-	-	-	20	-	-	-
Pb Conc. No. 1	-	-	-	15	12.5	-	-	-	-	5	4	8.8
Pb Conc. No. 2	-	-	-	5	2.5	-	-	-	-	1	3	-
Pb Conc. No. 3	-	-	-	5	2.5	-	-	-	-	1	3	-
Condition	-	-	-	-	-	1000	-	-	-	5	-	-
	-	-	-	-	-	-	500	-	-	5	-	10.6
Zn Rougher	-	-	-	25	-	-	-	10	-	1	4	-
	-	-	-	10	-	-	-	5	-	1	4	-

Metallurgical Results

Product	Weight %	Assays, %		% Distribution	
		Pb	Zn	Pb	Zn
1. Pb Conc. No. 1	12.95	36.4	7.86	87.9	15.7
2. Pb Conc. No. 2	3.18	5.64	9.23	3.3	4.5
3. Pb Conc. No. 3	2.77	3.51	8.26	1.8	3.5
4. Zn Ro. Conc.	21.05	0.65	22.6	2.6	73.5
5. Zn Ro. Tail.	60.05	0.39	0.30	4.4	2.8
Head (Calculated)	100.00	5.36	6.48	100.0	100.0

Calculated Grades and Recoveries

Products 1 and 2	16.13	30.3	8.13	91.2	20.2
Products 1 to 3	18.90	26.4	8.15	93.0	23.7
Products 4 and 5	81.10	0.46	6.09	7.0	76.3

Test No. 44

Purpose: To repeat test No. 43, but reduce cyanide addition to 25 g/t.

Procedure: As for test No. 37.

Feed: 2000 grams minus 10 mesh Composite No. 5.

Grind: 20 minutes at 65 % solids in the laboratory ball mill.

Conditions:

Stage	Reagents Added, grams per tonne								Time, minutes			pH
	Na_2CO_3	NaCN	LS-3	343	MIBC	$Ca(OH)_2$	$CuSO_4$	DF-1012	Grind	Cond.	Froth	
Grind	2500	25	75	15	-	-	-	-	20	-	-	-
Pb Conc. No. 1	-	-	-	15	12.5	-	-	-	-	5	4	8.7
Pb Conc. No. 2	-	-	-	5	2.5	-	-	-	-	1	3	-
Pb Conc. No. 3	-	-	-	5	2.5	-	-	-	-	1	3	-
Condition	-	-	-	-	-	1000	-	-	-	5	-	-
	-	-	-	-	-	-	500	-	-	5	-	10.7
Zn Rougher	-	-	-	25	-	-	-	10	-	1	4	-
	-	-	-	10	-	-	-	5	-	1	4	-

Metallurgical Results

Product	Weight %	Assays, %		% Distribution	
		Pb	Zn	Pb	Zn
1. Pb Conc. No. 1	14.23	30.9	7.13	84.2	15.2
2. Pb Conc. No. 2	1.81	5.77	10.5	2.0	2.9
3. Pb Conc. No. 3	1.96	4.46	9.58	1.7	2.8
4. Zn Ro. Conc.	23.22	1.20	21.7	5.3	75.7
5. Zn Ro. Tail.	58.78	0.60	0.38	6.8	3.4
Head (Calculated)	100.00	5.22	6.66	100.0	100.0

Calculated Grades and Recoveries

Products 1 and 2	16.04	28.1	7.51	86.2	18.1
Products 1 to 3	18.00	25.5	7.74	87.9	20.9
Products 4 and 5	82.00	0.77	6.42	12.1	79.1

Test No. 45

Purpose: To repeat test No. 44, but omit LS depressant.

Procedure: As for test No. 37.

Feed: 2000 grams minus 10 mesh Composite No. 5.

Grind: 20 minutes at 65 % solids in the laboratory ball mill.

Conditions:

Stage	Reagents Added, grams per tonne							Time, minutes			pH
	Na_2CO_3	NaCN	343	MIBC	$Ca(OH)_2$	$CuSO_4$	DF-1012	Grind	Cond.	Froth	
Grind	2500	25	15	-	-	-	-	20	-	-	-
Pb Conc. No. 1	-	-	15	12.5	-	-	-	-	5	4	8.7
Pb Conc. No. 2	-	-	5	2.5	-	-	-	-	1	3	-
Pb Conc. No. 3	-	-	5	2.5	-	-	-	-	1	3	-
Condition	-	-	-	-	1000	-	-	-	5	-	-
	-	-	-	-	-	500	-	-	5	-	10.7
Zn Rougher	-	-	25	-	-	-	10	-	1	4	-
	-	-	10	-	-	-	5	-	1	4	-

Metallurgical Results

Product	Weight %	Assays, %		% Distribution	
		Pb	Zn	Pb	Zn
1. Pb Conc. No. 1	15.41	29.2	7.20	85.3	16.9
2. Pb Conc. No. 2	1.90	5.52	9.82	2.0	2.8
3. Pb Conc. No. 3	1.88	4.93	9.59	1.8	2.7
4. Zn Ro. Conc.	29.23	1.12	16.9	6.2	75.3
5. Zn Ro. Tail.	51.58	0.48	0.29	4.7	2.3
Head (Calculated)	100.00	5.27	6.57	100.0	100.0

Calculated Grades and Recoveries

Products 1 and 2	17.31	26.6	7.49	87.3	19.7
Products 1 to 3	19.19	24.5	7.69	89.1	22.4
Products 4 and 5	80.81	0.71	6.30	10.9	77.6

Test No. 46

Purpose: To repeat the conditions of test No. 33 but regrind the copper rougher concentrate in the pebble mill before cleaning.

Procedure: As below.

Feed: 2000 grams minus 10 mesh Composite No. 1.

Grind: 23 minutes at 66 % solids in the laboratory ball mill.

Conditions:

Stage	Reagents Added, grams per tonne							Time, minutes			pH
	NH_4-OH	SO_2	NaCN	A350	Pine Oil	MIBC	A343	Grind	Cond.	Froth	
Grind	150	50	60	-	-	-	-	23	-	-	-
Aeration	100	-	-	-	-	-	-	-	15	-	9.3
Conditioning	-	-	-	4	5	-	-	-	10	-	-
Cu Rougher 1	-	-	-	-	-	-	-	-	1	2	8.9
Cu Rougher 2	-	-	-	2	2.5	-	-	-	1	2	-
Cu Rougher 3	-	-	-	2	2.5	-	-	-	1	3	-
Cu Conc. Regr.	-	150	-	-	-	-	-	10	-	-	-
Cu Cond.	-	1000	-	-	-	-	-	-	15	-	4.5
Cu 1st Cl. 1	-	-	-	-	-	2	-	-	1	2	-
Cu 1st Cl. 2	-	-	-	-	-	-	5	-	1	3	-
Cu 2nd Cl.	-	75	-	-	-	2	-	-	2	3	4.5
Cu 3rd Cl.	-	50	-	-	-	-	-	-	2	2	4.5

Combine Cu rougher and first cleaner tailing for zinc flotation.

Test No. 46 - Continued

Conditions:

Stage	Reagents Added, g/tonne					Time, minutes			pH
	NH_4OH	$CuSO_4$	A343	Pine Oil	MIBC	Grind	Cond.	Froth	
Zn Condition	200	-	-	-	-	-	5	-	-
	-	200	-	-	-	-	5	-	9.5
Zn Rougher	-	-	15	5	-	-	1	3	-
Zn Scavenger	-	-	10	2.5	-	-	1	2	-
Zn Ro. 1st Cl.	100	-	-	-	2	-	1	2	10.1
Zn 2nd Cl.	100	-	-	-	2	-	1	1.5	10.2
Zn 3rd Cl.	100	-	-	-	2	-	1	1	10.2

Metallurgical Results

Product	Weight %	Assays, %		% Distribution	
		Cu	Zn	Cu	Zn
1. Cu Cleaner Conc.	4.27	30.6	2.26	73.1	2.6
2. Cu 3rd Cl. Tail.	1.14	19.3	9.65	12.3	3.0
3. Cu 2nd Cl. Tail.	1.39	9.61	13.5	7.5	5.2
4. Zn Cleaner Conc.	4.84	0.62	58.6	1.7	77.9
5. Zn 3rd Cl. Tail.	0.04	1.99	31.9	0.1	0.4
6. Zn 2nd Cl. Tail.	0.25	2.64	19.3	0.3	1.3
7. Zn 1st Cl. Tail.	2.40	1.15	5.52	1.5	3.6
8. Zn Scav. Conc.	2.90	0.67	2.66	1.1	2.1
9. Zn Scav. Tail.	82.77	0.053	0.17	2.4	3.9
Head (Calculated)	100.00	1.79	3.64	100.0	100.0

Calculated Grades and Recoveries

Products 1 and 2	5.41	28.2	3.82	85.4	5.6
Products 1 to 3	6.80	24.4	5.80	92.9	10.8
Products 4 and 5	4.88	0.63	58.4	1.8	78.3
Products 4 to 6	5.13	0.73	56.5	2.1	79.6
Products 4 to 7	7.53	0.86	40.2	3.6	83.2
Products 4 to 8	10.43	0.81	29.8	4.7	85.3
Products 4 to 9	93.20	0.14	3.48	7.1	89.2
Products 8 and 9	85.67	0.074	0.25	3.5	6.0

Test No. 47

Purpose: To repeat test No. 46, but substitute depressant LS-3 for NaCN.

Procedure: As below.

Feed: 2000 grams minus 10 mesh Composite No. 1.

Grind: 23 minutes at 66 % solids in the laboratory ball mill.

Conditions:

Stage	Reagents Added, grams per tonne							Time, minutes			pH
	NH_4-OH	SO_2	LS-3	A350	Pine Oil	MIBC	A343	Grind	Cond.	Froth	
Prim. Grind	150	50	150	-	-	-	-	23	-	-	-
Aeration	100	-	-	-	-	-	-	-	15	-	9.2
Condition	-	-	-	4	5	-	-	-	10	-	-
Cu Rougher	-	-	-	-	-	-	-	-	1	2	8.8
	-	-	-	2	2.5	-	-	-	1	2	-
	-	-	-	2	-	-	-	-	1	3	-
Cu Conc. Regr.	-	-	50	-	-	-	-	10	-	-	-
Cu Condition	-	1100	-	-	-	-	-	-	15	-	4.5
Cu 1st Cl.	-	-	-	-	-	2	2.5	-	1	2	-
	-	-	-	-	-	2	5	-	1	3	-
Cu 2nd Cl.	-	75	-	-	-	2	2.5	-	2	3	4.5
Cu 3rd Cl.	-	50	-	-	-	2	1.0	-	2	2	4.5

Combine Cu rougher and 1st cleaner tailings for zinc flotation.

Test No. 47 - Continued

Conditions:

Stage	Reagents Added, g/tonne						Time, minutes			pH
	NH_4-OH	LS-3	$CuSO_4$	A343	Pine Oil	MIBC	Grind	Cond.	Froth	
Zn Condition	200	100	-	-	-	-	-	5	-	-
	-	-	200	-	-	-	-	5	-	9.0
Zn Rougher	-	-	-	15	5	-	-	1	3	-
Zn Scavenger	-	-	-	10	2.5	-	-	1	2	-
Zn Ro. 1st Cl.	100	-	-	-	-	2	-	1	2	-
Zn 2nd Cl.	100	-	-	-	-	2	-	1	1.5	-
Zn 3rd Cl.	100	-	-	-	-	2	-	1.	1	-

Metallurgical Results

Product	Weight %	Assays, %		% Distribution	
		Cu	Zn	Cu	Zn
1. Cu Cleaner Conc.	6.49	23.7	3.49	84.5	6.3
2. Cu 3rd Cl. Tail.	0.68	8.62	8.61	3.2	1.6
3. Cu 2nd Cl. Tail.	2.47	2.86	7.42	3.9	5.1
4. Zn Cleaner Conc.	4.50	0.48	57.7	1.2	71.9
5. Zn 3rd Cl. Tail.	0.06	3.20	25.2	0.1	0.4
6. Zn 2nd Cl. Tail.	0.25	2.86	12.4	0.4	0.9
7. Zn 1st Cl. Tail.	2.62	1.04	2.62	1.5	1.9
8. Zn Scav. Conc.	13.36	0.19	2.20	1.4	8.1
9. Zn Scav. Tail.	69.57	0.10	0.20	3.8	3.8
Head (Calculated)	100.00	1.82	3.61	100.0	100.0

Calculated Grades and Recoveries

Products 1 and 2	7.17	22.3	3.97	87.7	7.9
Products 1 to 3	9.64	17.3	4.86	91.6	13.0
Products 4 and 5	4.56	0.52	57.3	1.3	72.3
Products 4 to 6	4.81	0.64	54.9	1.7	73.2
Products 4 to 7	7.43	0.78	36.5	3.2	75.1
Products 4 to 8	20.79	0.40	14.5	4.6	83.2
Products 4 to 9	90.36	0.17	3.48	8.4	87.0
Products 8 and 9	82.93	0.11	0.52	5.2	11.9

Test No. 48

Purpose:	To repeat test No. 43, but replace LS-3 with an equal amount of LS-7.
Procedure:	As for test No. 43, but omit zinc circuit.
Feed:	2000 grams minus 10 mesh Composite No. 5.
Grind:	20 minutes at 65 % solids in the laboratory ball mill.

Conditions:

Stage	Reagents Added, grams per tonne					Time, minutes			pH
	Na_2CO_3	NaCN	LS-7	343	MIBC	Grind	Cond.	Froth	
Grind	2500	50	75	15	-	20	-	-	8.5
Pb Conc. No. 1	250	-	-	15	12.5	-	5	4	9.0
Pb Conc. No. 2	-	-	-	5	2.5	-	1	3	-
Pb Conc. No. 3	-	-	-	5	2.5	-	1	3	-

Metallurgical Results

Product	Weight %	Assays, %		% Distribution	
		Pb	Zn	Pb	Zn
1. Pb Conc. No. 1	12.19	37.7	7.62	85.7	14.0
2. Pb Conc. No. 2	2.37	7.49	9.31	3.3	3.3
3. Pb Conc. No. 3	2.81	4.71	9.03	2.5	3.8
4. Pb Flot. Tail.	82.63	0.55	6.32	8.5	78.9
Head (Calculated)	100.00	5.36	6.63	100.0	100.0

Calculated Grades and Recoveries

Products 1 and 2	14.56	32.8	7.89	89.0	17.3
Products 1 to 3	17.37	28.2	8.08	91.5	21.1

Test No. 49

Purpose: To repeat test No. 43, but replace depressant LS-3 with LS-8.

Procedure: As for test No. 48.

Feed: 2000 grams minus 10 mesh Composite No. 5.

Grind: 20 minutes at 65 % solids in the laboratory ball mill.

Conditions:

Stage	Reagents Added, g/tonne					Time, minutes			pH
	Na_2CO_3	NaCN	LS-8	343	MIBC	Grind	Cond.	Froth	
Grind	2500	50	75	15	-	20	-	-	-
Pb Conc. No. 1	-	-	-	15	12.5	-	5	4	-
Pb Conc. No. 2	-	-	-	5	2.5	-	1	3	-
Pb Conc. No. 3	-	-	-	5	2.5	-	1	3	-

Metallurgical Results

Product	Weight %	Assays, %		% Distribution	
		Pb	Zn	Pb	Zn
1. Pb Conc. No. 1	15.41	30.5	7.36	88.8	17.0
2. Pb Conc. No. 2	3.13	5.52	9.43	3.3	4.4
3. Pb Conc. No. 3	2.32	3.48	9.01	1.5	3.1
4. Pb Flot. Tail.	79.14	0.43	6.34	6.4	75.5
Head (Calculated)	100.00	5.29	6.66	100.0	100.0

Calculated Grades and Recoveries

Products 1 and 2	18.54	26.3	7.71	92.1	21.4
Products 1 to 3	20.86	23.7	7.85	93.6	24.5

Test No. 50

Purpose: To repeat the rougher conditions of test No. 42, and clean the concentrate as in test No. 2.

Procedure: Grind and float a lead concentrate. Regrind the concentrate and clean four times.

Feed: 2000 grams minus 10 mesh Composite No. 5.

Grind: 20 minutes at 65 % solids in the laboratory ball mill.

Conditions:

Stage	Reagents Added, g/tonne					Time, minutes			pH
	Na_2CO_3	NaCN	343	MIBC	$Ca(OH)_2$	Grind	Cond.	Froth	
Primary Grind	3000	50	15	-	-	20	-	-	-
Pb Rougher	-	-	15	12.5	-	-	5	4	9.2
	-	-	5	2.5	-	-	1	3	-
	-	-	5	2.5	-	-	1	3	-
Pb Conc. Regr.	500	25	2.5	-	-	10	-	-	-
Pb 1st Cl.	-	-	2.5	2.5	-	-	1	3	9.1
	-	-	5	2.5	-	-	1	3	-
Pb 2nd Cl.	-	25	-	-	-	-	1	2	9.0
	-	-	5	2.5	-	-	1	3	-
Pb 3rd Cl.	-	-	-	-	100	-	1	2	10.1
	-	-	-	2.5	-	-	1	2	-
Pb 4th Cl.	-	-	-	2.5	50	-	1	3	10.3

Test No. 50 - Continued

Metallurgical Results

Product	Weight	Assays, %		% Distribution	
	%	Pb	Zn	Pb	Zn
1. Pb Cleaner Conc.	7.73	56.0	6.13	82.6	7.2
2. Pb 4th Cl. Tail.	1.58	12.7	8.82	3.8	2.1
3. Pb 3rd Cl. Tail.	0.84	7.68	8.68	1.2	1.1
4. Pb 2nd Cl. Tail.	.51	5.75	9.12	2.8	3.5
5. Pb 1st Cl. Tail.	8.09	2.37	8.84	3.7	10.8
6. Pb Rougher Tail.	79.25	0.39	6.30	5.9	75.3
Head (Calculated)	100.00	5.24	6.62	100.0	100.0

Calculated Grades and Recoveries

Products 1 and 2	9.31	48.7	6.59	86.4	9.3
Products 1 to 3	10.15	45.3	6.76	87.6	10.4
Products 1 to 4	12.66	37.4	7.23	90.4	13.9
Products 1 to 5	20.75	23.8	7.86	94.1	24.7

Test No. 51

Purpose: To repeat test No. 50, but reduce cyanide addition to the cleaners by 50 percent.

Procedure: As for test No. 50.

Feed: 2000 grams minus 10 mesh Composite No. 5.

Grind: 20 minutes at 65 % solids in the laboratory ball mill.

Conditions:

Stage	Reagents Added, grams per tonne					Time, minutes			pH
	Na_2CO_3	NaCN	343	MIBC	$Ca(OH)_2$	Grind	Cond.	Froth	
Primary Grind	3000	50	15	-	-	20	-	-	-
Pb Rougher	-	-	15	12.5	-	-	5	4	9.0
	-	-	5	2.5	-	-	1	3	-
	-	-	5	2.5	-	-	1	3	-
Pb Conc. Regr.	500	15	2.5	-	-	10	-	-	-
Pb 1st Cl.	-	-	2.5	2.5	-	-	1	3	9.1
	-	-	5	2.5	-	-	1	3	-
Pb 2nd Cl.	-	10	-	-	-	-	1	2	9.0
	-	-	5	2.5	-	-	1	3	-
Pb 3rd Cl.	-	-	-	-	100	-	1	2	10.0
	-	-	-	2.5	-	-	1	2	-
Pb 4th Cl.	-	-	-	2.5	50	-	1	3	10.2

Test No. 51 - Continued

Metallurgical Results

Product	Weight	Assays, %		% Distribution	
	%	Pb	Zn	Pb	Zn
1. Pb Cleaner Conc.	7.60	53.6	5.58	79.7	6.3
2. Pb 4th Cl. Tail.	1.22	12.4	7.51	3.0	1.4
3. Pb 3rd Cl. Tail.	2.58	9.09	7.38	4.6	2.8
4. Pb 2nd Cl. Tail.	2.21	4.58	8.58	2.0	2.8
5. Pb 1st Cl. Tail.	7.09	2.62	9.45	3.6	10.0
6. Pb Rougher Tail.	79.30	0.46	6.46	7.1	76.7
Head (Calculated)	100.00	5.11	6.69	100.0	100.0

Calculated Grades and Recoveries

Products 1 and 2	8.82	47.9	5.85	82.7	7.7
Products 1 to 3	11.40	39.1	6.19	87.3	10.5
Products 1 to 4	13.61	33.5	6.58	89.3	13.3
Products 1 to 5	20.70	22.9	7.56	92.9	23.3

Test No. 52

Purpose: To repeat test No. 50, but reduce cyanide addition to the cleaners by 75 percent.

Procedure: As for test No. 50.

Feed: 2000 grams minus 10 mesh Composite No. 5.

Grind: 20 minutes at 65 % solids in the laboratory ball mill.

Conditions:

Stage	Reagents Added, grams per tonne					Time, minutes			pH
	Na_2CO_3	NaCN	343	MIBC	$Ca(OH)_2$	Grind	Cond.	Froth	
Primary Grind	3000	50	15	-	-	20	-	-	-
Pb Rougher	-	-	15	12.5	-	-	5	4	9.0
	-	-	5	2.5	-	-	1	3	-
	-	-	5	2.5	-	-	1	3	-
Pb Conc. Regr.	500	7.5	2.5	-	-	10	-	-	-
Pb 1st Cl.	-	-	2.5	2.5	-	-	1	3	8.9
	-	-	5	2.5	-	-	1	3	-
Pb 2nd Cl.	-	5	-	-	-	-	1	2	8.9
	-	-	5	2.5	-	-	1	3	-
Pb 3rd Cl.	-	-	-	-	100	-	1	2	10.0
	-	-	-	2.5	-	-	1	2	-
Pb 4th Cl.	-	-	-	2.5	50	-	1	3	10.1

Test No. 52 - Continued

Metallurgical Results

Product	Weight	Assays, %		% Distribution	
	%	Pb	Zn	Pb	Zn
1. Pb Cleaner Conc.	7.63	54.8	6.49	82.5	7.3
2. Pb 4th Cl. Tail.	0.86	13.1	7.34	2.2	0.9
3. Pb 3rd Cl. Tail.	1.56	11.3	7.77	3.5	1.8
4. Pb 2nd Cl. Tail.	2.35	5.65	9.37	2.6	3.3
5. Pb 1st Cl. Tail.	8.07	1.82	8.13	2.9	9.7
6. Pb Rougher Tail.	79.53	0.40	6.56	6.3	77.0
Head (Calculated)	100.00	5.07	6.77	100.0	100.0

Calculated Grades and Recoveries

Products 1 and 2	8.49	50.6	6.58	84.7	8.2
Products 1 to 3	10.05	44.5	6.76	88.2	10.0
Products 1 to 4	12.40	37.1	7.26	90.8	13.3
Products 1 to 5	20.47	23.2	7.60	93.7	23.0

Test No. 53

Purpose:	To repeat the conditions of test No. 35, but omit SO_2 and reduce collector addition to 2+1+0.5 g/t.
Procedure:	Grind, aerate and float three copper concentrates.
Feed:	2000 grams minus 10 mesh Composite No. 1.
Grind:	23 minutes at 65 % solids in the lab ball mill.

Conditions:

Stage	Reagents Added, g/tonne				Time, minutes			pH
	NH_4OH	LS-3	R-350	Pine Oil	Grind	Cond.	Froth	
Grind	150	150	-	-	23	-	-	-
Aeration	50	-	-	-	-	10	-	8.8
Cu Conc. No. 1	-	-	2.0	10	-	5	2	-
Cu Conc. No. 2	-	-	1.0	2.5	-	1	2	-
Cu Conc. No. 3	-	-	0.5	-	-	1	3	-

Metallurgical Results

Product	Weight %	Assays, %		% Distribution	
		Cu	Zn	Cu	Zn
1. Cu Conc. No. 1	9.99	14.1	6.04	81.2	16.9
2. Cu Conc. No. 2	5.78	3.98	7.09	13.3	11.6
3. Cu Conc. No. 3	1.91	1.53	11.3	1.6	6.0
4. Cu Flot. Tail.	82.32	0.082	2.84	3.9	65.5
Head (Calculated)	100.00	1.73	3.57	100.0	100.0

Calculated Grades and Recoveries

Products 1 and 2	15.77	10.39	6.46	94.5	28.5
Products 1 to 3	17.68	9.43	6.98	96.1	34.5

Test No. 54

Purpose: To repeat test No. 53, but replace NH_4OH with 700 g/t Na_2CO_3.

Procedure: As for test No. 53.

Feed: 2000 grams minus 10 mesh Composite No. 1.

Grind: 23 minutes at 65 % solids in the laboratory ball mill.

Conditions:

Stage	Reagents Added, g/tonne				Time, minutes			pH
	Na_2CO_3	LS-4	R-350	Pine Oil	Grind	Cond.	Froth	
Grind	700	150	-	-	23	-	-	-
Aeration	300	-	-	-	-	10	-	8.7
Cu Conc. No. 1	250	-	2.0	5	-	5	2	8.5
Cu Conc. No. 2	-	-	1.0	2.5	-	1	2	-
Cu Conc. No. 3	-	-	0.5	-	-	1	3	-

Metallurgical Results

Product	Weight %	Assays, %		% Distribution	
		Cu	Zn	Cu	Zn
1. Cu Conc. No. 1	12.16	11.2	3.66	77.9	12.4
2. Cu Conc. No. 2	7.88	3.16	4.86	14.2	10.7
3. Cu Conc. No. 3	6.13	0.80	6.99	2.8	12.0
4. Cu Flot. Tail.	73.83	0.12	3.14	5.1	64.9
Head (Calculated)	100.00	1.75	3.57	100.0	100.0

Calculated Grades and Recoveries

Products 1 and 2	20.04	8.05	4.13	92.1	23.1
Products 1 to 3	26.17	6.34	4.80	94.9	35.1

Test No. 55

Purpose: To repeat test No. 53, but replace LS-3 with LS-7.

Procedure: As for test No. 53.

Feed: 2000 grams minus 10 mesh Composite No. 1.

Grind: 23 minutes at 65 % solids in the laboratory ball mill.

Conditions:

Stage	Reagents Added, g/tonne				Time, minutes			pH
	NH_4OH	LS-7	R-350	Pine Oil	Grind	Cond.	Froth	
Grind	150	150	-	-	23	-	-	-
Aeration	50	-	-	-	-	10	-	8.9
Cu Conc. No. 1	-	-	2.0	5	-	5	2	-
Cu Conc. No. 2	-	-	1.0	2.5	-	1	2	-
Cu Conc. No. 3	-	-	0.5	-	-	1	3	-

Metallurgical Results

Product	Weight %	Assays, %		% Distribution	
		Cu	Zn	Cu	Zn
1. Cu Conc. No. 1	10.25	14.9	6.67	87.2	19.4
2. Cu Conc. No. 2	5.92	2.16	6.51	7.3	10.9
3. Cu Conc. No. 3	2.61	1.04	8.33	1.5	6.2
4. Cu Flot. Tail.	81.22	0.085	2.75	4.0	63.5
Head (Calculated)	100.00	1.75	3.51	100.0	100.0

Calculated Grades and Recoveries

Products 1 and 2	16.17	10.24	6.61	94.5	30.3
Products 1 to 3	18.78	8.96	6.84	96.0	36.5

Test No. 56

Purpose: To repeat test No. 55, but replace NH_4OH with 1000 g/t Na_2CO_3.

Procedure: As for test No. 53.

Feed: 2000 grams minus 10 mesh Composite No. 1.

Grind Conditions: 23 minutes at 65 % solids in the laboratory ball mill.

Stage	Reagents Added, g/tonne				Time, minutes			pH
	Na_2CO_3	LS-7	R-350	Pine Oil	Grind	Cond.	Froth	
Grind	1000	150	-	-	23	-	-	-
Aeration	100	-	-	-	-	10	-	8.8
Cu Conc. No. 1	100	-	1.0	5	-	5	2	8.6
Cu Conc. No. 2	-	-	0.5	2.5	-	1	2	-
Cu Conc. No. 3	-	-	0.5	-	-	1	3	-

Metallurgical Results

Product	Weight %	Assays, %		% Distribution	
		Cu	Zn	Cu	Zn
1. Cu Conc. No. 1	9.41	15.1	6.01	79.7	15.4
2. Cu Conc. No. 2	6.84	3.39	4.83	13.0	9.0
3. Cu Conc. No. 3	3.69	1.16	6.67	2.4	6.7
4. Cu Flot. Tail.	80.06	0.11	3.14	4.9	68.9
Head (Calculated)	100.00	1.78	3.66	100.0	100.0

Calculated Grades and Recoveries

Products 1 and 2	16.25	10.15	5.51	92.7	24.4
Products 1 to 3	19.94	8.50	5.72	95.1	31.1

Test No. 57

Purpose: To repeat test No. 53, but replace LS-3 with LS-8.

Procedure: As for test No. 53.

Feed: 2000 grams minus 10 mesh Composite No. 1.

Grind: 23 minutes at 65 % solids in the lab ball mill.

Conditions:

Stage	Reagents Added, g/tonne				Time, minutes			pH
	NH_4OH	LS-8	R-350	Pine Oil	Grind	Cond.	Froth	
Grind	150	150	-	-	23	-	-	-
Aeration	50	-	-	-	-	10	-	8.8
Cu Conc. No. 1	-	-	1.0	5	-	5	2	-
Cu Conc. No. 2	-	-	0.5	2.5	-	1	2	-
Cu Conc. No. 3	-	-	0.5	-	-	1	3	-

Metallurgical Results

Product	Weight %	Assays, %		% Distribution	
		Cu	Zn	Cu	Zn
1. Cu Conc. No. 1	5.18	23.3	8.43	65.5	12.1
2. Cu Conc. No. 2	2.28	12.6	12.5	15.6	7.9
3. Cu Conc. No. 3	1.52	6.08	10.9	5.0	4.6
4. Cu Flot. Tail.	91.02	0.28	2.97	13.9	75.4
Head (Calculated)	100.00	1.84	3.59	100.0	100.0

Calculated Grades and Recoveries

Products 1 and 2	7.46	20.03	9.67	81.1	20.0
Products 1 to 3	8.93	17.67	9.88	86.1	24.6

Test No. 58

Purpose:	To repeat test No. 57, but increase collector additions to 2.0-0.5-0.5.
Procedure:	As for test No. 53.
Feed:	2000 grams minus 10 mesh Composite No. 1.
Grind:	23 minutes at 65 % solids in the laboratory ball mill.

Conditions:

Stage	Reagents Added, g/tonne				Time, minutes			pH
	NH_4OH	LS-8	R-350	Pine Oil	Grind	Cond.	Froth	
Grind	150	150	-	-	23	-	-	-
Aeration	50	-	-	-	-	10	-	8.7
Cu Conc. No. 1	-	-	2.0	5	-	5	2	-
Cu Conc. No. 2	-	-	0.5	2.5	-	1	2	-
Cu Conc. No. 3	-	-	0.5	2.5	-	1	3	-

Metallurgical Results

Product	Weight %	Assays, %		% Distribution	
		Cu	Zn	Cu	Zn
1. Cu Conc. No. 1	6.53	22.0	8.02	80.4	14.5
2. Cu Conc. No. 2	2.38	7.53	12.5	10.0	8.2
3. Cu Conc. No. 3	2.33	3.56	10.7	4.6	6.9
4. Cu Flot. Tail.	88.76	0.10	2.87	4.9	70.4
Head (Calculated)	100.00	1.79	3.62	100.0	100.0

Calculated Grades and Recoveries

Products 1 and 2	8.91	18.13	9.22	90.4	22.7
Products 1 to 3	11.24	15.11	9.52	95.1	29.6

Test No. 59

Purpose: To repeat test No. 58, but omit depressant LS-8.

Procedure: As for test No. 53.

Feed: 2000 grams minus 10 mesh Composite No. 1.

Grind: 23 minutes at 65 % solids in the lab ball mill.

Conditions:

Stage	Reagents Added, grams per tonne			Time, minutes			pH
	NH_4OH	R-350	Pine Oil	Grind	Cond.	Froth	
Grind	150	-	-	23	-	-	-
Aeration	50	-	-	-	10	-	-
Cu Conc. No. 1	-	2.0	5	-	5	2	-
Cu Conc. No. 2	-	0.5	2.5	-	1	2	-
Cu Conc. No. 3	-	0.5	2.5	-	1	3	-

Metallurgical Results

Product	Weight %	Assays, %		% Distribution	
		Cu	Zn	Cu	Zn
1. Cu Conc. No. 1	9.08	17.2	8.58	88.0	21.6
2. Cu Conc. No. 2	3.83	2.89	8.10	6.2	8.6
3. Cu Conc. No. 3	2.96	1.28	9.81	2.1	8.1
4. Cu Flot. Tail.	84.13	0.076	2.64	3.7	61.7
Head (Calculated)	100.00	1.77	3.60	100.0	100.0

Calculated Grades and Recoveries

Products 1 and 2	12.91	12.95	8.43	94.2	30.2
Products 1 to 3	15.87	10.78	8.69	96.3	38.3

Test No. 60

Purpose: To repeat test No. 58, but replace LS-8 with 60 g/t NaCN.

Procedure: As for test No. 53.

Feed: 2000 grams minus 10 mesh Composite No. 1.

Grind: 23 minutes at 65 % solids in the laboratory ball mill.

Conditions:

Stage	Reagents Added, grams per tonne				Time, minutes			pH
	NH_4OH	NaCN	R-350	Pine Oil	Grind	Cond.	Froth	
Grind	150	60	-	-	23	-	-	-
Aeration	50	-	-	-	-	10	-	9.0
Cu Conc. No. 1	-	-	2.0	5	-	5	2	-
Cu Conc. No. 2	-	-	0.5	2.5	-	1	2	-
Cu Conc. No. 3	-	-	0.5	2.5	-	1	3	-

Metallurgical Results

Product	Weight %	Assays, %		% Distribution	
		Cu	Zn	Cu	Zn
1. Cu Conc. No. 1	3.49	17.7	6.36	35.4	3.4
2. Cu Conc. No. 2	2.44	12.6	7.49	17.6	5.4
3. Cu Conc. No. 3	2.58	8.76	6.96	12.9	5.3
4. Cu Flot. Tail.	91.49	0.65	3.21	34.1	85.9
Head (Calculated)	100.00	1.75	3.42	100.0	100.0

Calculated Grades and Recoveries

Products 1 and 2	5.93	15.62	5.06	53.0	8.8
Products 1 to 3	8.51	13.54	5.64	65.9	14.1

Test No. 61

Purpose: To repeat test No. 57, but omit collector additions to investigate the flotation of copper with pine oil only.

Procedure: As for test No. 53.

Feed: 2000 grams minus 10 mesh Composite No. 1.

Grind: 23 minutes at 65 % solids in the laboratory ball mill.

Conditions:

Stage	Reagents Added, grams per tonne			Time, minutes			pH
	NH_4OH	LS-8	Pine Oil	Grind	Cond.	Froth	
Grind	150	150	-	23	-	-	-
Aeration	50	-	-	-	10	-	8.7
Cu Conc. No. 1	-	-	10	-	5	2	-
Cu Conc. No. 2	-	-	2.5	-	1	2	-
Cu Conc. No. 3	-	-	2.5	-	1	3	-

Metallurgical Results

Product	Weight %	Assays, %		% Distribution	
		Cu	Zn	Cu	Zn
1. Cu Conc. No. 1	5.14	19.6	8.93	58.6	12.9
2. Cu Conc. No. 2	2.03	7.02	10.40	8.3	5.9
3. Cu Conc. No. 3	2.14	3.34	7.67	4.1	4.6
4. Cu Flot. Tail.	90.69	0.55	3.01	29.0	76.6
Head (Calculated)	100.00	1.72	3.56	100.0	100.0

Calculated Grades and Recoveries

Products 1 and 2	7.17	16.03	9.34	66.9	18.8
Products 1 to 3	9.31	13.12	8.96	71.0	23.4

Test No. 62

Purpose: To repeat test No. 61 (omitting collector), but omit the LS depressant as well.

Procedure: As for test No. 53.

Feed: 2000 grams minus 10 mesh Composite No. 1.

Grind: 23 minutes at 65 % solids in the lab ball mill.

Conditions:

Stage	Reagents Added, grams per tonne		Time, minutes			pH
	N_4OH	Pine Oil	Grind	Cond.	Froth	
Grind	150	-	23	-	-	-
Aeration	50	-	-	10	-	9.0
Cu Conc. No. 1	-	10	-	5	2	-
Cu Conc. No. 2	-	2.5	-	1	2	-
Cu Conc. No. 3	-	2.5	-	1	3	-

Metallurgical Results

Product	Weight	Assays, %		% Distribution	
	%	Cu	Zn	Cu	Zn
1. Cu Conc. No. 1	7.62	17.9	11.5	77.0	24.4
2. Cu Conc. No. 2	2.33	4.27	10.8	5.4	7.0
3. Cu Conc. No. 3	2.41	2.39	8.36	3.3	5.6
4. Cu Flot. Tail.	87.64	0.28	2.54	14.3	63.0
Head (Calculated)	100.00	1.77	3.60	100.0	100.0

Calculated Grades and Recoveries

Products 1 and 2	9.95	14.71	11.31	82.4	31.4
Products 1 to 3	12.36	12.30	10.73	85.7	37.0

Test No. 63

Purpose: To repeat test No. 48, but reduce NaCN addition to 25 g/t and slightly increase Na_2CO_3 and 343 additions.

Procedure: As for test No. 48.

Feed: 2000 grams minus 10 mesh Composite No. 5.

Grind: 20 minutes at 65 % solids in the laboratory ball mill.

Conditions:

Stage	Reagents Added, g/tonne					Time, minutes			pH
	Na_2CO_3	NaCN	LS-7	343	MIBC	Grind	Cond.	Froth	
Grind	3000	25	150	15	-	20	-	-	-
Pb Conc. No. 1	-	-	-	15	12.5	-	5	4	9.1
Pb Conc. No. 2	-	-	-	10	2.5	-	1	3	-
Pb Conc. No. 3	-	-	-	10	2.5	-	1	3	-

Metallurgical Results

Product	Weight	Assays, %		% Distribution	
	%	Pb	Zn	Pb	Zn
1. Pb Conc. No. 1	14.05	32.8	8.30	86.4	16.9
2. Pb Conc. No. 2	3.65	5.76	8.78	4.0	4.7
3. Pb Conc. No. 3	4.26	3.21	7.33	2.6	4.5
4. Pb Flot. Tail.	78.04	0.48	6.45	7.0	73.9
Head (Calculated)	100.00	5.32	6.85	100.0	100.0

Calculated Grades and Recoveries

Products 1 and 2	17.70	27.18	8.37	90.4	21.6
Products 1 to 3	21.96	22.53	8.17	93.0	26.1

Test No. 64

Purpose: To investigate the effect of adding small additions of depressant LS-7 to the lead cleaners.

Procedure: Grind and float a lead concentrate. Regrind the concentrate and clean four times.

Feed: 2000 grams minus 10 mesh Composite No. 5.

Grind: 20 minutes at 65 % solids in the laboratory ball mill.

Conditions:

Stage	Reagents Added, grams per tonne						Time, minutes			pH
	Na_2CO_3	NaCN	LS-7	343	MIBC	$Ca(OH)_2$	Grind	Cond.	Froth	
Primary Grind	3500	50	75	15	-	-	20	-	-	-
Pb Rougher	-	-	-	15	12.5	-	-	5	4	9.2
	-	-	-	5	2.5	-	-	1	3	-
	-	-	-	5	2.5	-	-	1	3	-
Pb Conc. Regr.	750	25	20	2.5	-	-	10	-	-	-
Pb 1st Cl.	-	-	-	2.5	2.5	-	-	1	3	9.5
	-	-	-	5.0	2.5	-	-	1	3	-
Pb 2nd Cl.	-	25	20	-	-	-	-	1	2	-
	-	-	-	5.0	2.5	-	-	1	3	-
Pb 3rd Cl.	-	-	20	-	-	100	-	1	2	10.2
	-	-	-	-	2.5	-	-	1	2	-
Pb 4th Cl.	-	-	10	-	2.5	50	-	1	3	-

Stage	Pb Rougher	Regrind	1st+2nd Cleaner	3rd+4th Cleaner
Flotation Cell	1000 g D - 1	Rod Mill	500 g D - 1	250 g D - 1
Speed: r.p.m.	1800	-	1300	1000
% Solids	33	-	-	-

Test No. 64 - Continued

Metallurgical Results

Product	Weight	Assays, %		% Distribution	
	%	Pb	Zn	Pb	Zn
1. Pb Cleaner Conc.	1.97	72.2	3.07	28.6	0.9
2. Pb 4th Cl. Tail.	2.58	64.4	4.82	33.4	1.9
3. Pb 3rd Cl. Tail.	2.00	38.6	9.27	15.5	2.8
4. Pb 2nd Cl. Tail.	2.85	13.9	11.2	8.0	4.8
5. Pb 1st Cl. Tail.	6.41	3.22	9.67	4.2	9.3
6. Pb Rougher Tail.	84.19	0.61	6.36	10.3	80.3
Head (Calculated)	100.00	4.97	6.66	100.0	100.0

Calculated Grades and Recoveries

Products 1 and 2	4.55	67.7	4.06	62.0	2.8
Products 1 to 3	6.55	58.9	5.65	77.5	5.6
Products 1 to 4	9.40	45.2	7.34	85.5	10.4
Products 1 to 5	15.81	28.2	8.28	89.7	19.7

Test No. 65

Purpose: To repeat test No. 64, but reduce depressant additions to the lead cleaners.

Procedure: As for test No. 64.

Feed: 2000 grams minus 10 mesh Composite No. 5.

Grind: 20 minutes at 65 % solids in the laboratory ball mill.

Conditions:

Stage	Reagents Added, grams per tonne						Time, minutes			pH
	Na_2CO_3	NaCN	LS-7	343	MIBC	$Ca(OH)_2$	Grind	Cond.	Froth	
Primary Grind	3500	50	75	15	-	-	20	-	-	-
Pb Rougher	-	-	-	15	12.5	-	-	5	4	9.2
	-	-	-	5	2.5	-	-	1	3	-
	-	-	-	5	2.5	-	-	1	3	-
Pb Conc. Regr.	750	15	20	2.5	-	-	10	-	-	-
Pb 1st Cl.	-	-	-	2.5	2.5	-	-	1	3	9.5
	-	-	-	5.0	2.5	-	-	1	3	-
Pb 2nd Cl.	-	10	10	-	-	-	-	1	2	9.3
	-	-	-	5.0	2.5	-	-	1	3	-
Pb 3rd Cl.	-	-	10	-	-	50	-	1	2	9.8
	-	-	-	-	2.5	-	-	1	2	-
Pb 4th Cl.	-	-	10	-	2.5	25	-	1	3	9.7

Test No. 65 - Continued

Metallurgical Results

Product	Weight	Assays, %		% Distribution	
	%	Pb	Zn	Pb	Zn
1. Pb Cleaner Conc.	6.05	62.7	1.07	75.8	1.0
2. Pb 4th Cl. Tail.	1.05	24.6	9.82	5.1	1.7
3. Pb 3rd Cl. Tail.	0.83	14.8	12.2	2.5	1.6
4. Pb 2nd Cl. Tail.	2.07	9.30	11.0	3.8	3.6
5. Pb 1st Cl. Tail.	8.11	2.75	9.21	4.5	12.0
6. Pb Rougher Tail.	81.89	0.51	6.11	8.3	80.1
Head (Calculated)	100.00	5.01	6.25	100.0	100.0

Calculated Grades and Recoveries

Products 1 and 2	7.10	57.1	2.36	80.9	2.7
Products 1 to 3	7.93	52.6	3.39	83.4	4.3
Products 1 to 4	10.00	43.7	4.97	87.2	7.9
Products 1 to 5	18.11	25.3	6.87	91.7	19.9

Test No. 66

Purpose: To repeat test No. 65, but further reduce NaCN additions to the lead cleaners.

Procedure: As for test No. 64.

Feed: 2000 grams minus 10 mesh Composite No. 5.

Grind: 20 minutes at 65 % solids in the laboratory ball mill.

Conditions:

Stage	Reagents Added, grams per tonne						Time, minutes			pH
	Na_2CO_3	NaCN	LS-7	343	MIBC	$Ca(OH)_2$	Grind	Cond.	Froth	
Primary Grind	3500	50	75	15	-	-	20	-	-	-
Pb Rougher	-	-	-	15	12.5	-	-	5	4	9.2
	-	-	-	5	2.5	-	-	1	3	-
	-	-	-	5	2.5	-	-	1	3	-
Pb Conc. Regr.	750	7.5	20	2.5	-	-	10	-	-	-
Pb 1st Cl.	-	-	-	2.5	2.5	-	-	1	3	9.4
	-	-	-	5.0	2.5	-	-	1	3	-
Pb 2nd Cl.	-	5	10	-	-	-	-	1	2	9.2
	-	-	-	5.0	2.5	-	-	1	3	-
Pb 3rd Cl.	-	-	10	-	-	50	-	1	2	9.6
	-	-	-	-	2.5	-	-	1	2	-
Pb 4th Cl.	-	-	10	-	-	25	-	1	3	9.6

Test No. 66 - Continued

Metallurgical Results

Product	Weight	Assays, %		% Distribution	
	%	Pb	Zn	Pb	Zn
1. Pb Cleaner Conc.	5.17	66.4	4.26	68.6	3.4
2. Pb 4th Cl. Tail.	1.53	34.8	9.35	10.6	2.2
3. Pb 3rd Cl. Tail.	1.13	16.0	10.5	3.7	1.8
4. Pb 2nd Cl. Tail.	2.07	9.36	10.4	3.9	3.3
5. Pb 1st Cl. Tail.	7.00	3.31	9.36	4.6	10.1
6. Pb Rougher Tail.	83.10	0.52	6.16	8.6	79.2
Head (Calculated)	100.00	5.00	6.47	100.0	100.0

Calculated Grades and Recoveries

Products 1 and 2	6.70	59.2	5.42	79.2	5.6
Products 1 to 3	7.83	53.0	6.16	82.9	7.4
Products 1 to 4	9.90	43.8	7.04	86.8	10.7
Products 1 to 5	16.90	27.1	8.00	91.4	20.8

Test No. 67

Purpose: To repeat tests No. 65 and 66, but omit NaCN entirely from the lead cleaners.

Procedure: As for test No. 64.

Feed: 2000 grams minus 10 mesh Composite No. 5.

Grind: 20 minutes at 65 % solids in the laboratory ball mill.

Conditions:

Stage	Reagents Added, grams per tonne						Time, minutes			pH
	Na_2CO_3	NaCN	LS-7	343	MIBC	$Ca(OH)_2$	Grind	Cond.	Froth	
Primary Grind	3500	50	75	15	-	-	20	-	-	-
Pb Rougher	-	-	-	15	12.5	-	-	5	4	9.2
	-	-	-	5	2.5	-	-	1	3	-
	-	-	-	5	2.5	-	-	1	3	-
Pb Conc. Regr.	750	-	20	2.5	-	-	10	-	-	-
Pb 1st Cl.	-	-	-	2.5	2.5	-	-	1	3	9.4
	-	-	-	5.0	2.5	-	-	1	3	-
Pb 2nd Cl.	-	-	10	-	-	-	-	1	2	9.2
	-	-	-	5.0	2.5	-	-	1	3	-
Pb 3rd Cl.	-	-	10	-	-	50	-	1	2	-
	-	-	-	-	2.5	-	-	1	2	-
Pb 4th Cl.	-	-	10	-	2.5	25	-	1	3	-

Test No. 67 - Continued

Metallurgical Results

Product	Weight	Assays, %		% Distribution	
	%	Pb	Zn	Pb	Zn
1. Pb Cleaner Conc.	5.27	62.4	5.26	64.3	4.3
2. Pb 4th Cl. Tail.	1.90	39.7	9.08	14.8	2.6
3. Pb 3rd Cl. Tail.	1.04	17.0	10.3	3.5	1.6
4. Pb 2nd Cl. Tail.	2.15	9.12	9.73	3.8	3.2
5. Pb 1st Cl. Tail.	7.57	3.24	9.08	4.8	10.6
6. Pb Rougher Tail.	82.07	0.55	6.17	8.8	77.7
Head (Calculated)	100.00	5.11	6.52	100.0	100.0

Calculated Grades and Recoveries

Products 1 and 2	7.17	56.4	6.27	79.1	6.9
Products 1 to 3	8.21	51.4	6.78	82.6	8.5
Products 1 to 4	10.36	42.6	7.39	86.4	11.7
Products 1 to 5	17.93	26.0	8.11	91.2	22.3

Test No. 68

Purpose: To repeat test No. 67, but omit the LS-7 additions from rougher and cleaners.

Procedure: As for test No. 64.

Feed: 2000 grams minus 10 mesh Composite No. 5.

Grind: 20 minutes at 65 % solids in the laboratory ball mill.

Conditions:

Stage	Reagents Added, g/tonne					Time, minutes			pH
	Na_2CO_3	NaCN	343	MIBC	$Ca(OH)_2$	Grind	Cond.	Froth	
Primary Grind	3500	50	15	-	-	20	-	-	-
Pb Rougher	-	-	15	12.5	-	-	5	4	9.2
	-	-	5	2.5	-	-	1	3	-
	-	-	5	2.5	-	-	1	3	-
Pb Conc. Regr.	750	-	2.5	-	-	10	-	-	-
Pb 1st Cl.	-	-	2.5	2.5	-	-	1	3	9.4
	-	-	5.0	2.5	-	-	1	3	-
Pb 2nd Cl.	-	-	-	-	-	-	1	2	9.2
	-	-	5.0	2.5	-	-	1	3	-
Pb 3rd Cl.	-	-	-	-	50	-	1	2	9.8
	-	-	-	2.5	-	-	1	2	-
Pb 4th Cl.	-	-	-	2.5	25	-	1	3	9.8

Test No. 68 - Continued

Metallurgical Results

Product	Weight %	Assays, %		% Distribution	
		Pb	Zn	Pb	Zn
1. Pb Cleaner Conc.	7.35	53.5	5.97	78.5	6.6
2. Pb 4th Cl. Tail.	0.68	21.2	9.12	2.9	0.9
3. Pb 3rd Cl. Tail.	1.87	19.4	10.2	7.2	2.8
4. Pb 2nd Cl. Tail.	2.07	5.75	10.1	2.5	3.1
5. Pb 1st Cl. Tail.	7.94	1.87	8.70	3.0	10.4
6. Pb Rougher Tail.	80.09	0.37	6.34	5.9	76.2
Head (Calculated)	100.00	5.00	6.67	100.0	100.0

Calculated Grades and Recoveries

Products 1 and 2	8.03	50.76	6.23	81.4	7.5
Products 1 to 3	9.90	44.83	6.98	88.6	10.3
Products 1 to 4	11.97	38.08	7.52	91.1	13.4
Products 1 to 5	19.91	23.64	7.99	94.1	23.8

Test No. 69

Purpose: To repeat the rougher conditions of test No. 63, but clean as in test No. 66, except increase 343 to cleaners.

Procedure: As for test No. 64.

Feed: 2000 grams minus 10 mesh Composite No. 5.

Grind: 20 minutes at 65 % solids in the laboratory ball mill.

Conditions:

Stage	Reagents Added, grams per tonne						Time, minutes			pH
	Na_2CO_3	NaCN	LS-7	343	MIBC	$Ca(OH)_2$	Grind	Cond.	Froth	
Primary Grind	3500	25	150	15	-	-	20	-	-	-
Pb Rougher	-	-	-	15	12.5	-	-	5	4	9.1
	-	-	-	10	2.5	-	-	1	3	-
	-	-	-	10	2.5	-	-	1	3	-
Pb Conc. Regr.	750	7.5	20	5	-	-	10	-	-	-
Pb 1st Cl.	-	-	-	5	2.5	-	-	1	3	9.4
	-	-	-	7.5	2.5	-	-	1	3	-
Pb 2nd Cl.	-	5	10	2.5	-	-	-	1	2	9.2
	-	-	-	5	-	-	-	1	3	-
Pb 3rd Cl.	-	-	10	-	-	50	-	1	2	9.6
	-	-	-	5	-	-	-	1	2	-
Pb 4th Cl.	-	-	10	-	-	25	-	1	3	9.6

Test No. 69 - Continued

Metallurgical Results

Product	Weight %	Assays, %		% Distribution	
		Pb	Zn	Pb	Zn
1. Pb Cleaner Conc.	7.59	55.0	6.93	80.5	8.0
2. Pb 4th Cl. Tail.	0.76	14.7	9.50	2.1	1.1
3. Pb 3rd Cl. Tail.	2.36	9.10	9.05	4.1	3.2
4. Pb 2nd Cl. Tail.	3.26	3.70	6.20	2.3	3.1
5. Pb 1st Cl. Tail.	8.02	1.96	7.24	3.4	8.8
6. Pb Rougher Tail.	78.01	0.50	6.37	7.6	75.8
Head (Calculated)	100.00	5.19	6.56	100.0	100.0

Calculated Grades and Recoveries

Products 1 and 2	8.35	51.32	7.17	82.6	9.1
Products 1 to 3	10.71	42.02	7.58	86.7	12.3
Products 1 to 4	13.97	33.08	7.26	89.0	15.4
Products 1 to 5	21.99	21.82	7.25	92.4	24.2

Test No. 70

Purpose: To investigate the effect of omitting SO_2 from the grind and of cleaning the Cu-Pb concentrate after rod mill regrinding.

Procedure: Grind, aerate and float a Cu-Pb concentrate. Regrind the concentrate and clean three times.

Feed: 2000 grams minus 10 mesh Composite No. 4.

Grind: 40 minutes at 66 % solids in the laboratory ball mill.

Conditions:

Stage	Reagents Added, g/tonne				Time, minutes			pH
	Na_2CO_3	343/ 350*	241	MIBC	Grind	Cond.	Froth	
Primary Grind	2500	-	-	-	40	-	-	7.9
Aeration	1250	-	-	-	-	30	-	9.2
Cu-Pb Rougher	750	10	10	10	-	1	2	9.2
	200	10	10	-	-	1	2	-
	250	10	10	-	-	1	2	-
	250	10	10	-	-	1	2	-
Conc. Regrind	500	-	-	-	15	-	-	-
Cu-Pb 1st Cl.	400	2.5	-	2.5	-	1	3	9.6
	-	2.5	-	2.5	-	1	3	-
Cu-Pb 2nd Cl.	250	-	-	-	-	1	2	9.6
	-	2	-	2	-	1	3	-
Cu-Pb 3rd Cl.	200	-	-	2	-	1	4	9.6

* 4:1 ratio of 343:350

Stage	Rougher	Regrind	Cleaners
Flotation Cell	1000 g D - 1	Rod Mill	500 g D - 1
Speed: r.p.m.	1800	-	1300
% Solids	33	-	-

Test No. 70 - Continued

Metallurgical Results

Product	Weight %	Assays, %			% Distribution		
		Cu	Pb	Zn	Cu	Pb	Zn
1. Cu-Pb Cleaner Conc.	12.32	2.27	18.7	7.99	81.7	68.9	11.8
2. Cu-Pb 3rd Cl. Tail.	2.77	0.31	4.24	10.4	2.5	3.5	3.5
3. Cu-Pb 2nd Cl. Tail.	4.64	0.17	2.74	10.1	2.3	3.8	5.6
4. Cu-Pb 1st Cl. Tail.	12.20	0.11	1.82	10.3	3.9	6.6	15.1
5. Cu-Pb Rougher Tail.	68.07	0.048	0.84	7.80	9.6	17.2	64.0
Head (Calculated)	100.00	0.34	3.34	8.30	100.0	100.0	100.0

Calculated Grades and Recoveries

Products 1 and 2	15.09	1.91	16.04	8.43	84.2	72.4	15.3
Products 1 to 3	19.73	1.50	12.91	8.82	86.5	76.2	20.9
Products 1 to 4	31.93	0.97	8.68	9.39	90.4	82.8	36.0

Test No. 71

Purpose: To repeat test No. 70, but add depressant LS-3 to rougher and cleaners.

Procedure: As for test No. 70.

Feed: 2000 grams minus 10 mesh Composite No. 4.

Grind: 40 minutes at 66 % solids in the laboratory ball mill.

Conditions:

Stage	Reagents Added, g/tonne					Time, minutes			pH
	Na_2CO_3	LS-3	343/ 350	241	MIBC	Grind	Cond.	Froth	
Primary Grind	2500	150	-	-	-	40	-	-	7.8
Aeration	1200	-	-	-	-	-	30	-	9.2
Cu-Pb Rougher	750	-	10	10	10	-	1	2	9.2
	200	-	10	10	-	-	1	2	-
	250	-	10	10	-	-	1	2	-
	250	-	10	10	-	-	1	2	-
Conc. Regring	500	30	-	-	-	15	-	-	-
Cu-Pb 1st Cl.	400	-	2.5	-	2.5	-	1	3	9.6
	-	-	2.5	-	2.5	-	1	3	-
Cu-Pb 2nd Cl.	250	15	-	-	-	-	1	2	9.6
	-	-	2	-	2	-	1	3	-
Cu-Pb 3rd Cl.	200	15	-	-	2	-	1	4	9.6

Test No. 71 - Continued

Metallurgical Results

Product	Weight	Assays, %			% Distribution		
	%	Cu	Pb	Zn	Cu	Pb	Zn
1. Cu-Pb Cleaner Conc.	11.54	2.40	20.2	8.45	80.0	70.0	11.1
2. Cu-Pb 3rd Cl. Tail.	3.90	0.32	4.39	10.3	3.5	5.1	4.6
3. Cu-Pb 2nd Cl. Tail.	5.41	0.19	2.56	10.9	2.8	4.0	6.7
4. Cu-Pb 1st Cl. Tail.	13.03	0.10	1.44	9.96	3.7	5.5	14.9
5. Cu-Pb Rougher Tail.	66.12	0.054	0.77	8.28	10.0	15.4	62.7
Head (Calculated)	100.00	0.35	3.33	8.74	100.0	100.0	100.0

Calculated Grades and Recoveries

Products 1 and 2	15.44	1.87	16.20	8.92	83.5	75.1	15.7
Products 1 to 3	20.85	1.44	12.66	9.43	86.3	79.1	22.4
Products 1 to 4	33.88	0.92	8.35	9.63	90.0	84.6	37.3

Test No. 72

Purpose: To repeat test No. 70, but add depressant LS-7 to rougher and cleaners.

Procedure: As for test No. 70.

Feed: 2000 grams minus 10 mesh Composite No. 4.

Grind: 40 minutes at 66 % solids in the laboratory ball mill.

Conditions:

Stage	Reagents Added, g/tonne					Time, minutes			pH
	Na_2CO_3	LS-7	343/350	241	MIBC	Grind	Cond.	Froth	
Primary Grind	2500	150	-	-	-	40	-	-	8.0
Aeration	1200	-	-	-	-	-	30	-	9.2
Cu-Pb Rougher	750	-	10	10	10	-	1	2	9.2
	200	-	10	10	-	-	1	2	-
	250	-	10	10	-	-	1	2	-
	250	-	10	10	-	-	1	2	-
Conc. Regrind	500	30	-	-	-	15	-	-	-
Cu-Pb 1st Cl.	400	-	2.5	-	2.5	-	1	3	9.6
	-	-	2.5	-	2.5	-	1	3	-
Cu-Pb 2nd Cl.	250	15	-	-	-	-	1	2	9.6
	-	-	2	-	2	-	1	3	-
Cu-Pb 3rd Cl.	200	15	-	-	2	-	1	4	9.6

Test No. 72 - Continued

Metallurgical Results

Product	Weight	Assays, %			% Distribution		
	%	Cu	Pb	Zn	Cu	Pb	Zn
1. Cu-Pb Cleaner Conc.	10.07	2.59	20.3	8.52	78.0	64.1	9.8
2. Cu-Pb 3rd Cl. Tail.	3.90	0.32	5.73	9.85	3.7	7.0	4.4
3. Cu-Pb 2nd Cl. Tail.	4.99	0.22	3.33	10.6	3.3	5.2	6.1
4. Cu-Pb 1st Cl. Tail.	12.70	0.11	1.71	10.6	4.2	6.8	15.4
5. Cu-Pb Rougher Tail.	68.34	0.053	0.79	8.21	10.8	16.9	64.3
Head (Calculated)	100.00	0.33	3.19	8.73	100.0	100.0	100.0

Calculated Grades and Recoveries

Products 1 and 2	13.97	1.96	16.23	8.89	81.7	71.1	14.2
Products 1 to 3	18.96	1.50	12.84	9.34	85.0	76.3	20.3
Products 1 to 4	31.66	0.94	8.37	9.85	89.2	83.1	35.7

Test No. 73

Purpose: To repeat test No. 70, but add depressant LS-8 to rougher and cleaners.

Procedure: As for test No. 70.

Feed: 2000 grams minus 10 mesh Composite No. 4.

Grind: 40 minutes at 66 % solids in the laboratory ball mill.

Conditions:

Stage	Reagents Added, g/tonne					Time, minutes			pH
	Na_2CO_3	LS-8	343/ 350	241	MIBC	Grind	Cond.	Froth	
Primary Grind	2500	150	-	-	-	40	-	-	-
Aeration	1300	-	-	-	-	-	30	-	9.2
Cu-Pb Rougher	750	-	10	10	10	-	1	2	9.2
	200	-	10	10	-	-	1	2	-
	250	-	10	10	-	-	1	2	-
	250	-	10	10	-	-	1	2	-
Conc. Regrind	500	30	-	-	-	15	-	-	-
Cu-Pb 1st Cl.	400	-	2.5	-	2.5	-	1	3	9.6
	-	-	2.5	-	2.5	-	1	3	-
Cu-Pb 2nd Cl.	250	15	-	-	-	-	1	2	9.6
	-	-	2	-	2	-	1	3	-
Cu-Pb 3rd Cl.	200	15	-	-	2	-	1	4	9.6

Test No. 73 - Continued

Metallurgical Results

Product	Weight	Assays, %			% Distribution		
	%	Cu	Pb	Zn	Cu	Pb	Zn
1. Cu-Pb Cleaner Conc.	10.68	2.69	21.6	8.10	80.9	67.6	10.0
2. Cu-Pb 3rd Cl. Tail.	3.29	0.35	5.37	10.70	3.2	5.2	4.1
3. Cu-Pb 2nd Cl. Tail.	4.79	0.21	3.03	10.80	2.9	4.3	6.0
4. Cu-Pb 1st Cl. Tail.	14.04	0.11	1.79	11.1	4.3	7.4	18.0
5. Cu-Pb Rougher Tail.	67.20	0.046	0.79	7.98	8.7	15.5	61.9
Head (Calculated)	100.00	0.36	3.41	8.66	100.0	100.0	100.0

Calculated Grades and Recoveries

Products 1 and 2	13.97	2.14	17.78	8.71	84.1	72.8	14.1
Products 1 to 3	18.76	1.65	14.01	9.25	87.0	77.1	20.1
Products 1 to 4	32.80	0.99	8.78	10.04	91.3	84.5	38.1

Test No. 74

Purpose: To repeat the rougher conditions of test No. 58, and clean the concentrate after regrinding.

Procedure: Grind, aerate and float a copper concentrate. Regrind the concentrate and clean three times.

Feed: 2000 grams minus 10 mesh Composite No. 1.

Grind: 23 minutes at 65 % solids in the laboratory ball mill.

Conditions:

Stage	Reagents Added, grams per tonne							Time, minutes			pH
	NH_4-OH	LS-8	R350	Pine Oil	SO_2	R343	MIBC	Grind	Cond.	Froth	
Primary Grind	150	150	-	-	-	-	-	23	-	-	-
Aeration	50	-	-	-	-	-	-	-	10	-	-
Cu Rougher	-	-	2.0	5.0	-	-	-	-	5	2	8.8
	-	-	0.5	2.5	-	-	-	-	1	2	-
	-	-	0.5	2.5	-	-	-	-	1	3	-
Conc. Regr.	-	-	-	-	100	-	-	10	-	-	-
Condition	-	-	-	-	850	-	-	-	15	-	4.5
Cu 1st Cl.	-	-	-	-	-	-	2	-	1	2	-
	-	-	-	-	-	5	-	-	1	2	-
Cu 2nd Cl.	-	-	-	-	100	-	2	-	2	3	4.5
Cu 3rd Cl.	-	-	-	-	40	-	2	-	2	2	4.5

Stage	Aeration	Rougher	Regrind	1st+2nd Cl.	3rd Cleaner
Flotation Cell	1000 g D-1	1000 g D-1	Pebble Mill	500 g D-1	250 g D-1
Speed: r.p.m.	1800	1800	-	1300	1000
% Solids	33	33	-	-	-

Test No. 74 - Continued

Metallurgical Results

Product	Weight %	Assays, %		% Distribution	
		Cu	Zn	Cu	Zn
1. Cu Cleaner Conc.	3.76	28.8	5.22	62.2	5.5
2. Cu 3rd Cl. Tail.	0.61	15.7	14.1	5.5	2.4
3. Cu 2nd Cl. Tail.	1.57	9.60	12.9	8.7	5.7
4. Cu 1st Cl. Tail.	3.57	3.15	11.4	6.5	11.5
5. Cu Rougher Tail.	90.49	0.33	2.94	17.1	74.9
Head (Calculated)	100.00	1.74	3.55	100.0	100.0

Calculated Grades and Recoveries

Products 1 and 2	4.37	26.97	6.46	67.7	7.9
Products 1 to 3	5.94	22.38	8.16	76.4	13.6
Products 1 to 4	9.51	15.16	9.38	82.9	25.1

Test No. 75

Purpose: To repeat test No. 74, but clean at pH 5.5.

Procedure: As for test No. 74.

Feed: 2000 grams minus 10 mesh Composite No. 1.

Grind: 23 minutes at 65 % solids in the laboratory ball mill.

Conditions:

Stage	Reagents Added, grams per tonne							Time, minutes			pH
	NH_4-OH	LS-8	R350	Pine Oil	SO_2	R343	MIBC	Grind	Cond.	Froth	
Prim. Grind	150	150	-	-	-	-	-	23	-	-	-
Aeration	50	-	-	-	-	-	-	-	10	-	8.8
Cu Rougher	-	-	2.0	5.0	-	-	-	-	5	2	-
	-	-	0.5	2.5	-	-	-	-	1	2	-
	-	-	0.5	2.5	-	-	-	-	1	3	-
Conc. Regrind	-	-	-	-	100	-	-	10	-	-	-
Condition	-	-	-	-	350	-	-	-	15	-	5.5
Cu 1st Cl.	-	-	-	-	-	-	2	-	1	2	-
	-	-	-	-	-	5	-	-	1	2	-
Cu 2nd Cl.	-	-	-	-	50	-	2	-	2	3	5.5
Cu 3rd Cl.	-	-	-	-	20	-	2	-	2	2	5.5

Test No. 75 - Continued

Metallurgical Results

Product	Weight %	Assays, % Cu	Assays, % Zn	% Distribution Cu	% Distribution Zn
1. Cu Cleaner Conc.	6.78	23.7	7.29	88.4	13.9
2. Cu 3rd Cl. Tail.	0.94	2.57	12.3	1.3	3.2
3. Cu 2nd Cl. Tail.	7.76	0.96	5.17	4.1	11.3
4. Cu 1st Cl. Tail.	8.57	0.33	3.96	1.6	9.5
5. Cu Rougher Tail.	75.95	0.11	2.91	4.6	62.1
Head (Calculated)	100.00	1.82	3.56	100.0	100.0

Calculated Grades and Recoveries

Products 1 and 2	7.72	21.13	7.90	89.7	17.1
Products 1 to 3	15.48	11.02	6.53	93.8	28.4
Products 1 to 4	24.05	7.21	5.62	95.4	37.9

Test No. 76

Purpose: To repeat test No. 74, but clean at pH 6.0.

Procedure: As for test No. 74.

Feed: 2000 grams minus 10 mesh Composite No. 1.

Grind: 23 minutes at 65 % solids in the laboratory ball mill.

Conditions:

Stage	Reagents Added, grams per tonne							Time, minutes			pH
	NH_4-OH	LS-8	R350	Pine Oil	SO_2	R343	MIBC	Grind	Cond.	Froth	
Prim. Grind	150	150	-	-	-	-	-	23	-	-	-
Aeration	50	-	-	-	-	-	-	-	10	-	8.9
Cu Rougher	-	-	2.0	5.0	-	-	-	-	5	2	-
	-	-	0.5	2.5	-	-	-	-	1	2	-
	-	-	0.5	2.5	-	-	-	-	1	3	-
Conc. Regr.	-	-	-	-	100	-	-	10	-	-	-
Condition	-	-	-	-	250	-	-	-	15	-	6.0
Cu 1st Cl.	-	-	-	-	-	-	2	-	1	2	-
	-	-	-	-	-	5	2	-	1	2	-
Cu 2nd Cl.	-	-	-	-	40	-	2	-	2	3	6.0
Cu 3rd Cl.	-	-	-	-	20	-	2	-	2	2	6.0

Test No. 76 - Continued

Metallurgical Results

Product	Weight	Assays, %		% Distribution	
	%	Cu	Zn	Cu	Zn
1. Cu Cleaner Conc.	4.14	27.6	6.67	66.2	7.8
2. Cu 3rd Cl. Tail.	0.36	8.80	18.5	1.9	1.9
3. Cu 2nd Cl. Tail.	1.53	5.62	14.2	5.0	6.1
4. Cu 1st Cl. Tail.	3.71	1.58	6.82	3.4	7.1
5. Cu Rougher Tail.	90.26	0.45	3.03	23.5	77.1
Head (Calculated)	100.00	1.73	3.55	100.0	100.0

Calculated Grades and Recoveries

Products 1 and 2	4.50	26.10	7.62	68.1	9.6
Products 1 to 3	6.03	20.90	9.29	73.1	15.8
Products 1 to 4	9.74	13.54	8.35	76.5	22.9

Test No. 77

Purpose:	To repeat test No. 47, but with higher cell speed during aeration and flotation and cleaning at pH 6.5.
Procedure:	As for test No. 14.
Feed:	2000 grams minus 10 mesh Composite No. 1.
Grind:	23 minutes at 65 % solids in the laboratory ball mill.

Conditions:

Stage	Reagents Added, grams per tonne							Time, minutes			pH
	NH_4-OH	LS-8	R350	Pine Oil	SO_2	R343	MIBC	Grind	Cond.	Froth	
Prim. Grind	150	150	-	-	-	-	-	23	-	-	-
Aeration	50	-	-	-	-	-	-	-	10	-	8.9
Cu Rougher	-	-	2.0	5.0	-	-	-	-	5	2	-
	-	-	0.5	2.5	-	-	-	-	1	2	-
	-	-	0.5	2.5	-	-	-	-	1	3	-
Conc. Regr.	-	-	-	-	100	-	-	10	-	-	-
Condition	-	-	-	-	75	-	-	-	15	-	6.5
Cu 1st Cl.	-	-	-	-	-	-	2	-	1	2	-
	-	-	-	-	-	5	2	-	1	2	-
Cu 2nd Cl.	-	-	-	-	25	-	2	-	2	3	6.5
Cu 3rd Cl.	-	-	-	-	15	-	2	-	2	2	6.5

Stage	Aeration	Rougher	1st+2nd Cleaners	3rd Cleaner
Flotation Cell	1000 g D-1	1000 g D-1	500 g D-1	250 g D-1
Speed: r.p.m.	2400	2100	1800	1400
% Solids	35	33	-	-

Test No. 77 - Continued

Metallurgical Results

Product	Weight	Assays, %		% Distribution	
	%	Cu	Zn	Cu	Zn
1. Cu Cleaner Conc.	6.05	25.7	8.00	89.2	13.3
2. Cu 3rd Cl. Tail.	0.26	7.02	17.2	1.1	1.2
3. Cu 2nd Cl. Tail.	1.40	4.23	14.5	3.4	5.6
4. Cu 1st Cl. Tail.	3.81	0.73	6.98	1.6	7.3
5. Cu Rougher Tail.	88.48	0.093	2.99	4.7	72.6
Head (Calculated)	100.00	1.74	3.64	100.0	100.0

Calculated Grades and Recoveries

Products 1 and 2	6.31	24.93	8.38	90.3	14.5
Products 1 to 3	7.71	21.17	9.49	93.7	20.1
Products 1 to 4	11.52	14.41	8.66	95.3	27.4

Test No. 78

Purpose:	To repeat the previous tests, but with increased collector additions and flotation times and add LS-8 to the 1st and 2nd cleaners.
Procedure:	As for test No. 77.
Feed:	2000 grams minus 10 mesh Composite No. 1.
Grind:	23 minutes at 65 % solids in the lab ball mill.

Conditions:

Stage	Reagents Added, grams per tonne							Time, minutes			pH
	NH_4-OH	LS-8	R350	Pine Oil	SO_2	R343	MIBC	Grind	Cond.	Froth	
Prim. Grind	150	150	-	-	-	-	-	23	-	-	-
Aeration	50	-	-	-	-	-	-	-	10	-	-
Cu Rougher	-	-	2.0	5.0	-	-	-	-	5	2	8.9
	-	-	0.5	2.5	-	-	-	-	1	2	-
	-	-	0.5	2.5	-	-	-	-	1	3	-
	-	-	2.0	2.5	-	-	-	-	1	2	-
Conc. Regr.	-	20	-	-	100	-	-	10	-	-	-
Condition	-	-	-	-	1400	-	-	-	15	-	4.5
Cu 1st Cl.	-	-	-	-	-	2.5	2	-	1	2	-
	-	-	-	-	-	5.0	2	-	1	2	-
Cu 2nd Cl.	-	10	-	-	100	2	-	-	2	3	4.5
	-	-	-	-	-	2	-	-	1	1	-
Cu 3rd Cl.	-	-	-	-	75	-	2	-	2	2	4.5
	-	-	-	-	-	2	-	-	1	1	-

Stage	Aeration	Rougher
Flotation Cell	1000 g D - 1	1000 g D - 1
Speed: r.p.m.	2400	-
% Solids	35	-

Test No. 78 - Continued

Metallurgical Results

Product	Weight	Assays, %		% Distribution	
	%	Cu	Zn	Cu	Zn
1. Cu Cleaner Conc.	5.32	26.6	3.47	80.9	5.1
2. Cu 3rd Cl. Tail.	1.02	7.37	11.3	4.3	3.2
3. Cu 2nd Cl. Tail.	2.75	2.97	12.7	4.7	9.7
4. Cu 1st Cl. Tail.	4.82	1.01	9.76	2.8	13.0
5. Cu Rougher Tail.	86.09	0.15	2.89	7.3	69.0
Head (Calculated)	100.00	1.75	3.61	100.0	100.0

Calculated Grades and Recoveries

Products 1 and 2	6.34	23.51	4.73	85.2	8.3
Products 1 to 3	9.09	17.29	7.14	89.9	18.0
Products 1 to 4	13.91	11.65	8.05	92.7	31.0

Test No. 79

Purpose: To repeat test No. 78, but clean at pH 6.5.

Procedure: As for test No. 74.

Feed: 2000 grams minus 10 mesh Composite No. 1.

Grind: 23 minutes at 65 % solids in the lab ball mill.

Conditions:

Stage	Reagents Added, grams per tonne							Time, minutes			pH
	NH_4-OH	LS-8	R350	Pine Oil	SO_2	R343	MIBC	Grind	Cond.	Froth	
Prim. Grind	150	150	-	-	-	-	-	23	-	-	-
Aeration	50	-	-	-	-	-	-	-	10	-	8.9
Cu Rougher	-	-	4.0	5.0	-	-	-	-	5	2	-
	-	-	0.5	2.5	-	-	-	-	1	2	-
	-	-	0.5	2.5	-	-	-	-	1	3	-
Conc. Regrind	-	20	-	-	100	-	-	10	-	-	-
Condition	-	-	-	-	80	-	-	-	15	-	6.5
Cu 1st Cl.	-	-	-	-	-	2.5	2	-	1	2	-
	-	-	-	-	-	5.0	2	-	1	2	-
Cu 2nd Cl.	-	10	-	-	20	2	-	-	2	3	6.5
	-	-	-	-	-	2	2	-	1	2	-
Cu 3rd Cl.	-	-	-	-	15	-	-	-	2	2	6.5
	-	-	-	-	-	2	-	-	1	1	-

Test No. 79 - Continued

Metallurgical Results

Product	Weight	Assays, %		% Distribution	
	%	Cu	Zn	Cu	Zn
1. Cu Cleaner Conc.	5.94	25.4	8.77	86.8	15.2
2. Cu 3rd Cl. Tail.	0.48	7.58	20.5	2.1	1.4
3. Cu 2nd Cl. Tail.	1.47	4.13	10.1	3.5	4.3
4. Cu 1st Cl. Tail.	5.05	0.71	3.89	2.1	5.7
5. Cu Rougher Tail.	87.06	0.11	2.89	5.5	73.4
Head (Calculated)	100.00	1.74	3.43	100.0	100.0

Calculated Grades and Recoveries

Products 1 and 2	6.42	24.06	8.87	88.9	16.6
Products 1 to 3	7.89	20.35	9.09	92.4	20.9
Products 1 to 4	12.94	12.69	7.06	94.5	26.6

Test No. 80

Purpose: To repeat the cyanide circuit conditions, but regrind the copper rougher concentrate prior to cleaning.

Procedure: As for test No. 77.

Feed: 2000 grams minus 10 mesh Composite No. 1.

Grind: 23 minutes at 65 % solids in the laboratory ball mill.

Conditions:

Stage	Reagents Added, grams per tonne							Time, minutes			pH
	NH_4-OH	NaCN	R350	Pine Oil	SO_2	R343	MIBC	Grind	Cond.	Froth	
Prim. Grind	150	35	-	-	-	-	-	23	-	-	-
Condition	50	25	-	-	-	-	-	-	2	-	9.1
Aeration	-	-	-	-	-	-	-	-	10	-	-
Cu Rougher	-	-	4	10	-	-	-	-	5	2	8.7
	-	-	2	2.5	-	-	-	-	1	2	-
	-	-	2	-	-	-	-	-	1	3	-
	-	-	2	2.5	-	-	-	-	1	2	-
Cu Conc. Regr.	-	-	-	-	-	-	-	10	-	-	-
Condition	-	-	-	-	950	-	-	-	15	-	4.5
Cu 1st Cl.	-	-	-	-	-	2.5	2	-	1	2	-
	-	-	-	-	-	5.0	2	-	1	2	-
Cu 2nd Cl.	-	-	-	-	80	1.2	2	-	2	3	4.5
Cu 3rd Cl.	-	-	-	-	50	-	2	-	2	2	4.5

Test No. 80 - Continued

Metallurgical Results

Product	Weight %	Assays, %		% Distribution	
		Cu	Zn	Cu	Zn
1. Cu Cleaner Conc.	4.52	28.6	2.83	71.4	3.6
2. Cu 3rd Cl. Tail.	0.87	8.71	11.5	4.2	2.8
3. Cu 2nd Cl. Tail.	1.36	2.70	10.7	2.0	4.1
4. Cu 1st Cl. Tail.	4.44	0.75	7.08	1.8	8.9
5. Cu Rougher Tail.	88.81	0.42	3.20	20.6	80.6
Head (Calculated)	100.00	1.81	3.53	100.0	100.0

Calculated Grades and Recoveries

Products 1 and 2	5.39	25.39	.23	75.6	6.4
Products 1 to 3	6.75	20.81	5.53	77.6	10.5
Products 1 to 4	11.19	12.85	6.14	79.4	19.4

Test No. 81

Purpose: To repeat test No. 80, but clean at pH 6.5.

Procedure: As for test No. 77.

Feed: 2000 grams minus 10 mesh Composite No. 1.

Grind: 23 minutes at 65 % solids in the lab ball mill.

Conditions:

Stage	Reagents Added, grams per tonne							Time, minutes			pH
	NH_4-OH	NaCN	R350	Pine Oil	SO_2	R343	MIBC	Grind	Cond.	Froth	
Prim. Grind	150	35	-	-	-	-	-	23	-	-	-
Condition	50	25	-	-	-	-	-	-	2	-	9.1
Aeration	-	-	-	-	-	-	-	-	10	-	-
Cu Rougher	-	-	4	10	-	-	-	-	5	2	-
	-	-	2	2.5	-	-	-	-	1	2	-
	-	-	2	-	-	-	-	-	1	3	-
	-	-	2	2.5	-	-	-	-	1	2	-
Cu Conc. Regr.	-	-	-	-	-	-	-	10	-	-	-
Condition	-	-	-	-	75	-	-	-	15	-	6.5
Cu 1st Cl.	-	-	-	-	-	2.5	2	-	1	2	-
	-	-	-	-	-	5.0	2	-	1	2	-
Cu 2nd Cl.	-	-	-	-	20	1.2	2	-	2	3	6.5
Cu 3rd Cl.	-	-	-	-	15	-	2	-	2	2	6.5

Test No. 81 - Continued

Metallurgical Results

Product	Weight %	Assays, %		% Distribution	
		Cu	Zn	Cu	Zn
1. Cu Cleaner Conc.	5.65	26.7	4.61	85.3	7.4
2. Cu 3rd Cl. Tail.	0.64	5.33	13.9	1.9	2.5
3. Cu 2nd Cl. Tail.	1.45	2.08	10.5	1.7	4.3
4. Cu 1st Cl. Tail.	4.89	0.60	6.48	1.6	9.0
5. Cu Rougher Tail.	87.37	0.19	3.11	9.5	76.8
Head (Calculated)	100.00	1.77	3.54	100.0	100.0

Calculated Grades and Recoveries

Products 1 and 2	6.29	24.52	5.59	87.2	9.9
Products 1 to 3	7.74	20.32	6.48	88.9	14.2
Products 1 to 4	12.63	12.68	6.48	90.5	23.2

Test No. 82

Purpose: To repeat test No. 71, but increase regrind time and clean in larger cells to give a more dilute pulp.

Procedure: As for test No. 70.

Feed: 2000 grams minus 10 mesh Composite No. 4.

Grind: 40 minutes at 66 % solids in the laboratory ball mill.

Conditions:

Stage	Reagents Added, g/tonne					Time, minutes			pH
	Na_2CO_3	LS-3	343/ 350	241	MIBC	Grind	Cond.	Froth	
Primary Grind	2500	150	-	-	-	40	-	-	-
Aeration	1200	-	-	-	-	-	30	-	9.2
Cu-Pb Rougher	750	-	10	10	10	-	1	2	9.2
	200	-	10	10	-	-	1	2	-
	250	-	10	10	-	-	1	2	-
	250	-	10	10	-	-	1	2	-
Conc. Regrind	500	30	-	-	-	20	-	-	-
Cu-Pb 1st Cl.	400	-	2.5	2.5	2.5	-	1	3	9.6
	-	-	2.5	-	2.5	-	1	3	-
Cu-Pb 2nd Cl.	300	15	-	-	2	-	1	2	9.6
	-	-	2	-	2	-	1	3	-
Cu-Pb 3rd Cl.	250	15	-	-	2	-	1	4	9.6

Stage	Aeration	Rougher	Regrind	1st+2nd Cl.	3rd Cleaner
Flotation Cell	1000 g D-1	1000 g D-1	Rod Mill	1000 g D-1	500 g D-1
Speed: r.p.m.	2000	2000	-	1800	1400
% Solids	35	33	-	-	-

Test No. 82 - Continued

Metallurgical Results

Product	Weight %	Assays, %			% Distribution		
		Cu	Pb	Zn	Cu	Pb	Zn
1. Cu-Pb Cleaner Conc.	10.84	2.45	19.00	7.14	74.5	64.3	8.9
2. Cu-Pb 3rd Cl. Tail.	2.47	0.36	4.68	7.45	2.5	3.6	2.1
3. Cu-Pb 2nd Cl. Tail.	6.25	0.30	3.29	8.07	5.2	6.4	5.8
4. Cu-Pb 1st Cl. Tail.	15.40	0.17	2.07	12.0	7.3	10.0	21.2
5. Cu-Pb Rougher Tail.	65.04	0.057	0.77	8.28	10.5	15.7	62.0
Head (Calculated)	100.00	0.36	3.20	8.69	100.0	100.0	100.0

Calculated Grades and Recoveries

Products 1 and 2	13.31	2.06	16.34	7.20	77.0	67.9	11.0
Products 1 to 3	19.56	1.05	12.17	7.47	82.2	74.3	16.8
Products 1 to 4	34.96	0.91	8.49	9.47	89.5	84.3	38.0

Test No. 83

Purpose: To repeat test No. 82, but omit the LS-3 depressant.

Procedure: As for test No. 70.

Feed: 2000 grams minus 10 mesh Composite No. 4.

Grind: 40 minutes at 66 % solids in the laboratory ball mill.

Conditions:

Stage	Reagents Added, g/tonne				Time, minutes			pH
	Na_2CO_3	343/ 350	241	MIBC	Grind	Cond.	Froth	
Primary Grind	2500	-	-	-	40	-	-	-
Aeration	1200	-	-	-	-	30	-	9.2
Cu-Pb Rougher	750	10	10	10	-	1	2	-
	-	10	10	-	-	1	2	-
	-	10	10	-	-	1	2	-
	-	10	10	-	-	1	2	-
Conc. Regrind	500	-	-	-	20	-	-	-
Cu-Pb 1st Cl.	400	2.5	2.5	2.5	-	1	3	9.6
	-	2.5	-	2.5	-	1	3	-
Cu-Pb 2nd Cl.	300	-	-	2	-	1	2	9.6
	-	2	-	2	-	1	3	-
Cu-Pb 3rd Cl.	250	-	-	2	-	1	4	9.6

Test No. 83 - Continued

Metallurgical Results

Product	Weight %	Assays, %			% Distribution		
		Cu	Pb	Zn	Cu	Pb	Zn
1. Cu-Pb Cleaner Conc.	10.88	2.48	19.7	7.58	77.6	66.5	9.9
2. Cu-Pb 3rd Cl. Tail.	1.92	0.34	5.25	8.94	1.9	3.1	2.0
3. Cu-Pb 2nd Cl. Tail.	5.05	0.24	3.53	9.76	3.5	5.5	5.8
4. Cu-Pb 1st Cl. Tail.	16.12	0.14	1.97	11.00	6.5	9.9	21.1
5. Cu-Pb Rougher Tail.	66.03	0.056	0.73	7.82	10.5	15.0	61.2
Head (Calculated)	100.00	3.48	3.22	8.42	100.0	100.0	100.0

Calculated Grades and Recoveries

Products 1 and 2	12.80	2.23	17.53	7.78	79.5	69.6	11.9
Products 1 to 3	17.85	1.62	13.57	8.34	83.0	75.1	17.7
Products 1 to 4	33.97	0.92	8.06	9.60	89.5	85.0	38.8

Test No. 84

Purpose: To repeat test No. 69, but omit depressant LS-7.

Procedure: As for test No. 64.

Feed: 2000 grams minus 10 mesh Composite No. 5.

Grind: 20 minutes at 65 % solids in the lab ball mill.

Conditions:

Stage	Reagents Added, grams per tonne					Time, minutes			pH
	Na_2CO_3	NaCN	343	MIBC	$Ca(OH)_2$	Grind	Cond.	Froth	
Primary Grind	3500	25	15	-	-	20	-	-	-
Pb Rougher	-	-	15	12.5	-	-	5	4	9.2
	-	-	10	2.5	-	-	1	3	-
	-	-	10	2.5	-	-	1	3	-
Pb Conc. Regr.	750	7.5	5	-	-	10	-	-	-
Pb 1st Cl.	-	-	5	2.5	-	-	1	3	9.7
	-	-	7.5	2.5	-	-	1	3	-
Pb 2nd Cl.	-	5	2.5	-	-	-	1	2	9.6
	-	-	5	2.5	-	-	1	3	-
Pb 3rd Cl.	-	-	-	-	50	-	1	2	9.9
	-	-	5	2.5	-	-	1	2	-
Pb 4th Cl.	-	-	-	2.5	25	-	1	3	9.9

Test No. 84 - Continued

Metallurgical Results

Product	Weight	Assays, %		% Distribution	
	%	Pb	Zn	Pb	Zn
1. Pb Cleaner Conc.	8.88	50.1	6.51	86.8	8.7
2. Pb 4th Cl. Tail.	0.59	7.13	8.77	0.8	0.8
3. Pb 3rd Cl. Tail.	2.22	4.71	8.36	2.0	2.8
4. Pb 2nd Cl. Tail.	3.21	1.99	7.67	1.2	3.7
5. Pb 1st Cl. Tail.	7.05	1.38	8.33	1.9	8.9
6. Pb Rougher Tail.	78.05	0.47	6.34	7.3	75.1
Head (Calculated)	100.00	5.12	6.61	100.0	100.0

Calculated Grades and Recoveries

Products 1 and 2	9.47	47.42	6.75	87.6	9.5
Products 1 to 3	11.69	39.34	7.06	89.6	12.3
Products 1 to 4	14.90	31.27	7.19	90.8	16.0
Products 1 to 5	21.95	21.67	7.56	92.7	24.9

Test No. 85

Purpose: To repeat test No. 84, but increase regrind time to 20 minutes.

Procedure: As for test No. 64.

Feed: 2000 grams minus 10 mesh Composite No. 5.

Grind: 20 minutes at 65 % solids in the lab ball mill.

Conditions:

Stage	Reagents Added, grams per tonne					Time, minutes			pH
	Na_2CO_3	NaCN	343	MIBC	$Ca(OH)_2$	Grind	Cond.	Froth	
Primary Grind	3500	25	15	-	-	20	-	-	-
	-	-	15	12.5	-	-	5	4	9.3
	-	-	10	2.5	-	-	1	3	-
	-	-	10	2.5	-	-	1	3	-
Pb Conc. Regr.	750	7.5	5	-	-	20	-	-	-
Pb 1st Cl.	-	-	5	2.5	-	-	1	3	9.6
	-	-	7.5	2.5	-	-	1	3	-
Pb 2nd Cl.	-	5	2.5	-	-	-	1	2	9.5
	-	-	5	2.5	-	-	1	3	-
Pb 3rd Cl.	-	-	-	-	50	-	1	2	9.9
	-	-	5	2.5	-	-	1	2	-
Pb 4th Cl.	-	-	-	2.5	25	-	1	3	9.9

Test No. 85 - Continued

Metallurgical Results

Product	Weight	Assays, %		% Distribution	
	%	Pb	Zn	Pb	Zn
1. Pb Cleaner Conc.	8.80	51.8	7.14	88.4	9.8
2. Pb 4th Cl. Tail.	0.65	7.79	11.3	1.0	1.1
3. Pb 3rd Cl. Tail.	1.51	4.95	8.93	1.4	2.2
4. Pb 2nd Cl. Tail.	3.18	1.94	7.25	1.2	3.6
5. Pb 1st Cl. Tail.	10.56	1.02	7.02	2.1	11.5
6. Pb Rougher Tail.	75.30	0.40	6.12	5.9	71.8
Head (Calculated)	100.00	5.15	6.42	100.0	100.0

Calculated Grades and Recoveries

Products 1 and 2	9.45	48.77	7.42	89.4	10.9
Products 1 to 3	10.96	42.73	7.69	90.8	13.1
Products 1 to 4	14.14	33.56	7.59	92.0	16.7
Products 1 to 5	24.70	19.65	7.35	94.1	28.2

Test No. 86

Purpose: To repeat test No. 85, but increase NaCN addition to the rougher to 100 g/t.

Procedure: As for test No. 64.

Feed: 2000 grams minus 10 mesh Composite No. 5.

Grind: 20 minutes at 65 % solids in the laboratory ball mill.

Conditions:

Stage	Reagents Added, grams per tonne					Time, minutes			pH
	Na_2CO_3	NaCN	343	MIBC	$Ca(OH)_2$	Grind	Cond.	Froth	
Primary Grind	3500	100	15	-	-	20	-	-	-
Pb Rougher	-	-	15	12.5	-	-	5	4	9.5
	-	-	10	2.5	-	-	1	3	-
	-	-	10	2.5	-	-	1	3	-
Pb Conc. Regr.	750	7.5	5	-	-	20	-	-	-
Pb 1st Cl.	-	-	5	2.5	-	-	1	3	9.7
	-	-	7.5	2.5	-	-	1	3	-
Pb 2nd Cl.	-	5	2.5	-	-	-	1	2	9.5
	-	-	5	2.5	-	-	1	3	-
Pb 3rd Cl.	-	-	-	-	50	-	1	2	9.8
	-	-	5	2.5	-	-	1	2	-
Pb 4th Cl.	-	-	-	2.5	25	-	1	3	9.8

Test No. 86 - Continued

Metallurgical Results

Product	Weight %	Assays, %		% Distribution	
		Pb	Zn	Pb	Zn
1. Pb Cleaner Conc.	7.97	54.9	5.03	85.6	6.0
2. Pb 4th Cl. Tail.	0.56	13.6	8.61	1.5	0.7
3. Pb 3rd Cl. Tail.	1.72	10.2	9.68	3.4	2.5
4. Pb 2nd Cl. Tail.	2.62	4.13	11.6	2.1	4.6
5. Pb 1st Cl. Tail.	10.25	1.06	8.34	2.1	12.9
6. Pb Rougher Tail.	76.88	0.35	6.34	5.3	73.3
Head (Calculated)	100.00	5.11	6.64	100.0	100.0

Calculated Grades and Recoveries

Products 1 and 2	8.53	52.19	5.26	87.1	6.7
Products 1 to 3	10.25	45.14	6.00	90.5	9.2
Products 1 to 4	12.87	36.79	7.14	92.6	13.8
Products 1 to 5	23.12	20.95	7.67	94.7	26.7

Test No. 87

Purpose: To repeat test No. 69, but double regrind time to 20 minutes.

Procedure: As for test No. 64.

Feed: 2000 grams minus 10 mesh Composite No. 5.

Grind: 20 minutes at 65 % solids in the lab ball mill.

Conditions:

Stage	Reagents Added, grams per tonne						Time, minutes			pH
	Na_2CO_3	NaCN	LS-7	343	MIBC	$Ca(OH)_2$	Grind	Cond.	Froth	
Primary Grind	3500	25	150	15	-	-	20	-	-	-
Pb Rougher	-	-	-	15	12.5	-	-	5	4	9.1
	-	-	-	10	2.5	-	-	1	3	-
	-	-	-	10	2.5	-	-	1	3	-
Pb Conc. Regr.	750	7.5	20	5	-	-	20	-	-	-
Pb 1st Cl.	-	-	-	5	2.5	-	-	1	3	9.5
	-	-	-	7.5	2.5	-	-	1	3	-
Pb 2nd Cl.	-	5	10	2.5	-	-	-	1	2	-
	-	-	-	5	2.5	-	-	1	3	-
Pb 3rd Cl.	-	-	10	-	-	50	-	1	2	10.0
	-	-	-	5	2.5	-	-	1	2	-
Pb 4th Cl.	-	-	10	-	2.5	25	-	1	3	10.1

Test No. 87 - Continued

Metallurgical Results

Product	Weight	Assays, %			% Distribution	
	%	Cu	Pb	Zn	Pb	Zn
1. Pb Cleaner Conc.	6.45	1.01	57.8	7.56	73.2	7.2
2. Pb 4th Cl. Tail.	0.43	-	19.6	12.00	1.6	0.7
3. Pb 3rd Cl. Tail.	2.08	-	15.6	12.50	6.4	3.8
4. Pb 2nd Cl. Tail.	2.24	-	8.63	7.09	3.8	2.3
5. Pb 1st Cl. Tail.	7.03	-	3.59	6.54	5.0	6.8
6. Pb Rougher Tail.	81.77	-	0.62	6.58	10.0	79.2
Head (Calculated)	100.00	-	5.08	6.80	100.0	100.0

Calculated Grades and Recoveries

Products 1 and 2	6.88	-	55.41	7.84	74.8	7.9
Products 1 to 3	8.96	-	46.17	8.92	81.2	11.7
Products 1 to 4	11.20	-	35.49	8.55	85.0	14.0
Products 1 to 5	18.23	-	25.14	7.78	90.0	20.8

Test No. 88

Purpose: To repeat test No. 87, but with increased NaCN and decreased LS-7 to the grind.

Procedure: As for test No. 64.

Feed: 2000 grams minus 10 mesh Composite No. 5.

Grind: 20 minutes at 65 % solids in the laboratory ball mill.

Conditions:

Stage	Reagents Added, grams per tonne						Time, minutes			pH
	Na_2CO_3	NaCN	LS-7	343	MIBC	$Ca(OH)_2$	Grind	Cond.	Froth	
Primary Grind	3500	50	40	15	-	-	20	-	-	-
Pb Rougher	-	-	-	15	12.5	-	-	5	4	9.1
	--	-	-	10	2.5	-	-	1	3	-
	-	-	-	10	2.5	-	-	1	3	-
Pb Conc. Regr.	750	7.5	20	5	-	-	20	-	-	-
Pb 1st Cl.	-	-	-	5	2.5	-	-	1	3	9.6
	-	-	-	7.5	2.5	-	-	1	3	-
Pb 2nd Cl.	-	5	10	2.5	-	-	-	1	2	9.5
	-	-	-	5	2.5	-	-	1	3	-
Pb 3rd Cl.	-	-	10	-	-	50	-	1	2	10.0
	-	-	-	5	2.5	-	-	1	2	-
Pb 4th Cl.	-	-	10	-	2.5	25	-	1	3	10.0

Test No. 88 - Continued

Metallurgical Results

Product	Weight	Assays, %		% Distribution	
	%	Pb	Zn	Pb	Zn
1. Pb Cleaner Conc.	7.28	55.5	7.05	79.4	7.7
2. Pb 4th Cl. Tail.	1.13	21.6	10.8	4.8	1.8
3. Pb 3rd Cl. Tail.	1.82	10.4	8.64	3.7	2.4
4. Pb 2nd Cl. Tail.	2.68	4.66	7.91	2.4	3.2
5. Pb 1st Cl. Tail.	8.94	1.96	7.12	3.4	9.6
6. Pb Rougher Tail.	78.15	0.40	6.40	6.3	75.3
Head (Calculated)	100.00	5.09	6.64	100.0	100.0

Calculated Grades and Recoveries

Products 1 and 2	8.41	51.00	7.55	84.2	9.5
Products 1 to 3	10.23	43.73	7.74	87.9	11.9
Products 1 to 4	12.91	35.62	7.78	90.3	15.1
Products 1 to 5	21.85	21.86	7.51	93.7	24.7

Test No. 89

Purpose: To repeat test No. 88, but halve the LS-7 additions and increase the collector to the cleaners.

Procedure: As for test No. 64.

Feed: 2000 grams minus 10 mesh Composite No. 5.

Grind: 20 minutes at 65 % solids in the lab ball mill.

Conditions:

Stage	Reagents Added, grams per tonne						Time, minutes			pH
	Na_2CO_3	NaCN	LS-7	343	MIBC	$Ca(OH)_2$	Grind	Cond.	Froth	
Primary Grind	3500	50	40	15	-	-	20	-	-	-
Pb Rougher	-	-	-	15	12.5	-	-	5	4	9.2
	-	-	-	10	2.5	-	-	1	3	-
	-	-	-	10	2.5	-	-	1	3	-
Pb Conc. Regr.	750	7.5	10	5	-	-	20	-	-	-
Pb 1st Cl.	-	-	-	10	2.5	-	-	1	3	9.6
	-	-	-	10	2.5	-	-	1	3	-
Pb 2nd Cl.	-	5	5	5	2.5	-	-	1	2	-
	-	-	-	5	2.5	-	-	1	3	-
Pb 3rd Cl.	-	-	5	-	2.5	50	-	1	2	9.9
	-	-	-	5	2.5	-	-	1	2	-
Pb 4th Cl.	-	-	5	2.5	2.5	25	-	1	3	10.0

Test No. 89 - Continued

Metallurgical Results

Product	Weight	Assays, %		% Distribution	
	%	Pb	Zn	Pb	Zn
1. Pb Cleaner Conc.	7.00	57.2	4.83	78.7	5.0
2. Pb 4th Cl. Tail.	1.50	19.7	8.11	5.8	1.8
3. Pb 3rd Cl. Tail.	1.99	10.9	8.71	4.3	2.6
4. Pb 2nd Cl. Tail.	3.74	3.43	8.50	2.5	4.7
5. Pb 1st Cl. Tail.	7.33	1.96	8.54	2.8	9.3
6. Pb Rougher Tail.	78.44	0.38	6.55	5.9	76.6
Head (Calculated)	100.00	5.08	6.71	100.0	100.0

Calculated Grades and Recoveries

Products 1 and 2	8.50	50.58	5.40	84.5	6.8
Products 1 to 3	10.49	43.05	6.03	88.8	9.4
Products 1 to 4	14.23	32.64	6.67	91.4	14.1
Products 1 to 5	21.56	22.21	7.31	94.1	23.4

Test No. 90

Purpose: To repeat test No. 89, but substitute LS-3 for LS-7.

Procedure: As for test No. 64.

Feed: 2000 grams minus 10 mesh Composite No. 5.

Grind: 20 minutes at 65 % solids in the laboratory ball mill.

Conditions:

Stage	Reagents Added, grams per tonne						Time, minutes			pH
	Na_2CO_3	NaCN	LS-3	343	MIBC	$Ca(OH)_2$	Grind	Cond.	Froth	
Primary Grind	3500	50	40	15	-	-	20	-	-	-
Pb Rougher	-	-	-	15	12.5	-	-	5	4	9.2
	-	-	-	10	2.5	-	-	1	3	-
	-	-	-	10	2.5	-	-	1	3	-
Pb Conc. Regr.	750	7.5	10	10	-	-	20	-	-	-
Pb 1st Cl.	-	-	-	10	2.5	-	-	1	3	9.6
	-	-	-	5	2.5	-	-	1	3	-
Pb 2nd Cl.	-	5	5	5	2.5	-	-	1	2	9.5
	-	-	-	5	2.5	-	-	1	3	-
Pb 3rd Cl.	-	-	5	-	2.5	50	-	1	2	10.0
	-	-	-	5	2.5	-	-	1	2	-
Pb 4th Cl.	-	-	5	2.5	2.5	25	-	1	3	10.1

Test No. 90 - Continued

Metallurgical Results

Product	Weight %	Assays, %		% Distribution	
		Pb	Zn	Pb	Zn
1. Pb Cleaner Conc.	8.18	53.2	8.22	86.2	10.3
2. Pb 4th Cl. Tail.	0.52	13.2	10.70	1.3	0.8
3. Pb 3rd Cl. Tail.	1.73	6.24	8.95	2.1	2.4
4. Pb 2nd Cl. Tail.	3.05	2.71	7.34	1.6	3.4
5. Pb 1st Cl. Tail.	7.45	1.64	5.34	2.4	6.1
6. Pb Rougher Tail.	79.07	0.40	6.45	6.4	77.0
Head (Calculated)	100.00	5.05	6.53	100.0	100.0

Calculated Grades and Recoveries

Products 1 and 2	8.70	50.80	9.47	87.5	11.1
Products 1 to 3	10.43	43.40	8.46	89.6	13.5
Products 1 to 4	13.48	34.20	7.70	91.2	16.9
Products 1 to 5	20.93	22.61	6.86	93.6	23.0

Test No. 91

Purpose:	To repeat test No. 90, but replace LS-3 with LS-3A (1:1 of LS-H:1902).
Procedure:	As for test No. 64.
Feed:	2000 grams minus 10 mesh Composite No. 5.
Grind:	20 minutes at 65 % solids in the laboratory ball mill.

Conditions:

Stage	Reagents Added, grams per tonne						Time, minutes			pH
	Na_2CO_3	NaCN	LS-3A	343	MIBC	$Ca(OH)_2$	Grind	Cond.	Froth	
Primary Grind	3500	50	40	15	-	-	20	-	-	-
Pb Rougher	-	-	-	15	12.5	-	-	5	4	9.2
	-	-	-	10	2.5	-	-	1	3	-
	-	-	-	10	2.5	-	-	1	3	-
Pb Conc. Regr.	750	7.5	10	10	-	-	20	-	-	-
Pb 1st Cl.	-	-	-	10	2.5	-	-	1	3	9.6
	-	-	-	5	2.5	-	-	1	3	-
Pb 2nd Cl.	-	5	5	5	2.5	-	-	1	2	-
	-	-	-	5	2.5	-	-	1	3	-
Pb 3rd Cl.	-	-	5	-	2.5	50	-	1	2	10.1
	-	-	-	5	2.5	-	-	1	2	-
Pb 4th Cl.	-	-	5	2.5	2.5	25	-	1	3	10.1

Test No. 91 - Continued

Metallurgical Results

Product	Weight %	Assays, %		% Distribution	
		Pb	Zn	Pb	Zn
1. Pb Cleaner Conc.	6.28	62.1	4.52	77.6	4.3
2. Pb 4th Cl. Tail.	1.06	28.0	9.16	5.9	1.5
3. Pb 3rd Cl. Tail.	1.80	13.6	9.74	4.9	2.7
4. Pb 2nd Cl. Tail.	2.91	4.18	10.20	2.4	4.5
5. Pb 1st Cl. Tail.	7.92	1.78	8.87	2.8	10.7
6. Pb Rougher Tail.	80.03	0.40	6.25	6.4	76.3
Head (Calculated)	100.00	5.02	6.55	100.0	100.0

Calculated Grades and Recoveries

Products 1 and 2	7.34	57.18	5.19	83.5	5.8
Products 1 to 3	9.14	48.59	6.08	88.7	8.5
Products 1 to 4	12.05	37.87	7.08	90.8	13.0
Products 1 to 5	19.97	23.55	7.79	93.6	23.7

Test No. 92

Purpose: To repeat test No. 90, but replace LS-3 with LS-3B (1:1 of LS-H:$ZnSO_4$).

Procedure: As for test No. 64.

Feed: 2000 grams minus 10 mesh Composite No. 5.

Grind: 20 minutes at 65 % solids in the lab ball mill.

Conditions:

Stage	Reagents Added, grams per tonne						Time, minutes			pH
	Na_2CO_3	NaCN	LS-3B	343	MIBC	$Ca(OH)_2$	Grind	Cond.	Froth	
Primary Grind	3500	50	40	15	-	-	20	-	-	-
Pb Rougher	-	-	-	15	12.5	-	-	5	4	9.1
	-	-	-	10	2.5	-	-	1	3	-
	-	-	-	10	2.5	-	-	1	3	-
Pb Conc. Regr.	750	7.5	10	10	-	-	20	-	-	-
Pb 1st Cl.	-	-	-	10	2.5	-	-	1	3	9.7
	-	-	-	5	2.5	-	-	1	3	-
Pb 2nd Cl.	-	5	5	5	2.5	-	-	1	2	9.6
	-	-	-	5	2.5	-	-	1	3	-
Pb 3rd Cl.	-	-	5	-	2.5	50	-	1	2	10.0
	-	-	-	5	2.5	-	-	1	2	-
Pb 4th Cl.	-	-	5	2.5	2.5	25	-	1	3	10.0

Test No. 92 - Continued

Metallurgical Results

Product	Weight %	Assays, %		% Distribution	
		Pb	Zn	Pb	Zn
1. Pb Cleaner Conc.	6.89	60.1	4.13	82.4	4.8
2. Pb 4th Cl. Tail.	1.02	21.9	9.88	4.4	1.5
3. Pb 3rd Cl. Tail.	1.07	11.8	10.2	2.5	1.6
4. Pb 2nd Cl. Tail.	2.16	3.71	10.3	1.6	3.3
5. Pb 1st Cl. Tail.	9.64	1.39	8.65	2.7	12.3
6. Pb Rougher Tail.	79.32	0.40	6.52	6.4	76.5
Head (Calculated)	100.00	5.02	6.76	100.0	100.0

Calculated Grades and Recoveries

Products 1 and 2	7.81	55.86	5.46	86.8	6.3
Products 1 to 3	8.88	50.56	6.04	89.3	7.9
Products 1 to 4	11.04	41.40	6.88	90.9	11.2
Products 1 to 5	20.68	22.75	7.70	93.6	23.5

Test No. 93

Purpose: To repeat test No. 90, but replace LS-3 with LS-3C (1:0.3:0.7 of LS-H:$ZnSO_4$:1902).

Procedure: As for test No. 64.

Feed: 2000 grams minus 10 mesh Composite No. 5.

Grind: 20 minutes at 65 % solids in the laboratory ball mill.

Conditions:

Stage	Reagents Added, grams per tonne						Time, minutes			pH
	Na_2CO_3	NaCN	LS-3C	343	MIBC	$Ca(OH)_2$	Grind	Cond.	Froth	
Prim. Grind	3500	50	40	15	-	-	20	-	-	-
Pb Rougher	-	-	-	15	12.5	-	-	5	4	9.2
	-	-	-	10	2.5	-	-	1	3	-
	-	-	-	10	2.5	-	-	1	3	-
Conc. Regr.	750	7.5	10	10	-	-	20	-	-	-
Pb 1st Cl.	-	-	-	10	2.5	-	-	1	3	9.7
	-	-	-	5	2.5	-	-	1	3	-
Pb 2nd Cl.	-	5	5	5	2.5	-	-	1	2	-
	-	-	-	5	2.5	-	-	1	3	-
Pb 3rd Cl.	-	-	5	-	2.5	50	-	1	2	10.0
	-	-	-	5	2.5	-	-	1	2	-
Pb 4th Cl.	-	-	5	2.5	2.5	25	-	1	3	10.0

Test No. 93 - Continued

Metallurgical Results

Product	Weight %	Assays, %		% Distribution	
		Pb	Zn	Pb	Zn
1. Pb Cleaner Conc.	7.14	58.7	5.19	83.0	5.5
2. Pb 4th Cl. Tail.	0.84	17.70	9.45	3.0	1.2
3. Pb 3rd Cl. Tail.	1.43	9.98	9.31	2.7	2.0
4. Pb 2nd Cl. Tail.	2.47	4.18	9.52	2.0	3.5
5. Pb 1st Cl. Tail.	8.64	1.71	8.39	2.8	10.8
6. Pb Flot. Tail.	79.48	0.40	6.48	6.5	77.0
Head (Calculated)	100.00	5.05	6.69	100.0	100.0

Calculated Grades and Recoveries

Products 1 and 2	7.98	54.4	5.63	86.0	6.7
Products 1 to 3	9.41	47.63	6.18	88.7	8.7
Products 1 to 4	11.88	38.60	6.88	90.7	12.2
Products 1 to 5	20.52	23.07	7.52	93.5	23.0

Test No. 94

Purpose: To repeat the conditions of test No. 78 but replace LS-8 with LS-3 made up from liquid sulphonate H.

Procedure: As shown below.

Feed: 2000 grams minus 10 mesh Composite No. 1.

Grind: 23 minutes at 65 % solids in a laboratory ball mill.

Conditions:

Stage	Reagents Added, grams per tonne							Time, minutes			pH
	NH_4-OH	LS-3	R350	Pine Oil	R343	MIBC	SO_2	Grind	Cond.	Froth	
Grinding	150	150	-	-	-	-	-	23	-	-	-
Aeration	50	-	-	-	-	-	-	-	10	-	-
Cu Rougher 1	-	-	2.5	5.0	-	-	-	-	5	2	-
Cu Rougher 2	-	-	0.5	2.5	-	-	-	-	1	2	-
Cu Rougher 3	-	-	0.5	2.5	-	-	-	-	1	3	-
Conc. Regr.	-	20		-	-	-	100	10	-	-	-
Conditioning	-	-	-	-	-	-	800	-	15	-	4.5
Cu 1st Cl. 1	-	-	-	-	2.5	2	-	-	1	2	-
Cu 1st Cl. 2	-	-	-	-	5	2	-	-	1	2	-
Cu 2nd Cl.	-	10	-	-	2	-	80	-	2	3	4.5
	-	-	-	-	2	-	-	-	1	1	-
Cu 3rd Cl.	-	-	-	-	-	2	50	-	2	1	4.5
	-	-	-	-	2	-	-	-	1	1	-

Test No. 94 - Continued

Metallurgical Results

Product	Weight	Assays, %		% Distribution	
	%	Cu	Zn	Cu	Zn
1. Cu 3rd Cl. Conc.	6.06	26.2	5.54	90.4	9.3
2. Cu 3rd Cl. Tail.	0.31	4.90	22.30	0.9	1.9
3. Cu 2nd Cl. Tail.	0.54	5.10	12.10	1.6	2.8
4. Cu 1st Cl. Tail.	6.21	0.74	8.02	2.6	13.8
5. Cu Flot. Tail.	86.88	0.091	3.00	4.5	72.2
Head (Calculated)	100.00	1.75	3.61	100.0	100.0

Calculated Grades and Recoveries

Products 1 and 2	6.37	25.16	6.34	91.3	11.2
Products 1 to 3	6.91	23.59	7.32	92.9	14.0
Products 1 to 4	13.12	12.77	7.65	95.5	27.8

Test No. 95

Purpose: To repeat the conditions of test No. 94 but replace LS-3 with LS-3A.

Procedure: As for test No. 95.

Feed: 2000 grams minus 10 mesh Composite No. 1.

Grind: 23 minutes at 65 % solids in a laboratory ball mill.

Conditions:

Stage	Reagents Added, grams per tonne							Time, minutes			pH
	NH_4-OH	LS3A	R350	Pine Oil	R343	MIBC	SO_2	Grind	Cond.	Froth	
Grinding	150	150	-	-	-	-	-	23	-	-	-
	-	-	-	-	-	-	-	-	10	-	-
Aeration	50	-	-	-	-	-	-	-	-	-	-
Cu Ro. 1	-	-	2.5	5	-	-	-	-	5	2	-
Cu Ro. 2	-	-	0.5	2.5	-	-	-	-	1	2	-
Cu Ro. 3	-	-	0.5	2.5	-	-	-	-	1	3	-
Cu Regrind	-	20	-	-	-	-	100	10	-	-	-
Conditioning	-	-	-	-	-	-	800	-	15	-	4.5
Cu 1st Cl. 1	-	-	-	-	2.5	2	-	-	1	2	-
Cu 1st Cl. 2	-	-	-	-	5	2	-	-	1	2	-
Cu 2nd Cl. 1	-	10	-	-	2	-	80	-	2	3	-
Cu 2nd Cl. 2	-	-	-	-	2	-	-	-	1	1	-
Cu 3rd Cl. 1	-	-	-	-	-	2	50	-	2	2	-
Cu 3rd Cl. 2	-	-	-	-	2	-	-	-	1	1	-

Test No. 95 - Continued

Metallurgical Results

Product	Weight	Assays, %		% Distribution	
	%	Cu	Zn	Cu	Pb
1. Cu Cleaner Conc.	4.61	29.0	2.78	74.3	3.5
2. Cu 3rd Cl. Tail.	0.85	17.1	3.85	8.1	0.9
3. Cu 2nd Cl. Tail.	0.87	8.36	7.13	4.0	1.7
4. Cu 1st Cl. Tail.	11.03	1.38	7.39	8.5	22.6
5. Cu Flot. Tail.	82.64	0.11	3.10	5.1	71.3
Head (Calculated)	100.00	1.79	3.60	100.0	100.0

Calculated Grades and Recoveries

Products 1 and 2	5.48	27.15	2.94	82.4	4.4
Products 1 to 3	6.33	24.56	3.52	86.4	6.1
Products 1 to 4	17.36	9.83	5.98	94.9	28.7

Test No. 96

Purpose: To repeat the conditions of test No. 95 but replace LS-3A with LS-3B.

Procedure: As for test No. 95.

Feed: 2000 grams minus 10 mesh Composite No. 1.

Grind: 23 minutes at 65 % solids in a laboratory ball mill.

Conditions:

Stage	Reagents Added, grams per tonne							Time, minutes			pH
	NH_4-OH	LS3B	R350	Pine Oil	R343	MIBC	SO_2	Grind	Cond.	Froth	
Grind	150	150	-	-	-	-	-	23	-	-	-
Aeration	50	-	-	-	-	-	-	-	10	-	-
Cu Ro. 1	-	-	2.5	5	-	-	-	-	5	2	-
Cu Ro. 2	-	-	0.5	2.5	-	-	-	-	1	2	-
Cu Ro. 3	-	-	0.5	2.5	-	-	-	-	1	3	-
Cu Regrind	-	20	-	-	-	-	100	10	-	-	-
Conditioning	-	-	-	-	-	-	750	-	15	-	4.5
	-	-	-	-	25	2	-	-	1	2	-
Cu 1st Cl. 1	-	-	-	-	5	2	-	-	1	2	-
Cu 1st Cl. 2	-	-	-	-	-	-	-	-	-	-	-
Cu 2nd Cl. 1	-	10	-	-	2	-	80	-	2	3	4.5
	-	-	-	-	2	2	-	-	1	1	-
Cu 3rd Cl.	-	-	-	-	-	-	40	-	2	2	-
	-	-	-	-	-	2	-	-	1	1	-

Test No. 96 - Continued

Metallurgical Results

Product	Weight %	Assays, %		% Distribution	
		Cu	Zn	Cu	Zn
1. Cu Cleaner Conc.	6.14	25.0	5.44	88.7	9.5
2. Cu 3rd Cl. Tail.	0.72	5.03	7.93	2.1	1.6
3. Cu 2nd Cl. Tail.	1.22	3.35	8.54	2.7	3.0
4. Cu 1st Cl. Tail.	8.06	0.44	6.17	2.0	14.2
5. Cu Flot. Tailing	83.86	0.10	2.99	4.5	71.7
Head (Calculated)	100.00	1.73	3.50	100.0	100.0

Calculated Grades and Recoveries

Products 1 and 2	6.86	22.90	5.70	90.8	11.1
Products 1 to 3	8.08	19.95	6.13	93.5	14.1
Products 1 to 4	16.14	10.21	6.15	95.5	28.3

Test No. 97

Purpose: To repeat the conditions of test No. 96 but replace LS-3B with LS-3C.

Procedure: As for test No. 95.

Feed: 2000 grams minus 10 mesh Composite No. 1.

Grind: 23 minutes at 65 % solids in the laboratory ball mill.

Conditions:

Stage	Reagents Added, grams per tonne							Time, minutes			pH
	NH_4-OH	LS3C	R350	Pine Oil	R343	MIBC	SO_2	Grind	Cond.	Froth	
Grind	150	150	-	-	-	-	-	23	-	-	-
Aeration	50	-	-	-	-	-	-	-	10	-	9.0
Cu Rougher	-	-	2.5	5	-	-	-	-	5	2	-
	-	-	0.5	2.5	-	-	-	-	1	2	-
	-	-	0.5	2.5	-	-	-	-	1	3	-
Conc. Regrind	-	20	-	-	-	-	100	10	-	-	-
Conditioning	-	-	-	-	-	-	950	-	15	-	4.5
Cu 1st Cl.	-	-	-	-	2.5	2	-	-	1	2	-
	-	-	-	-	5	2	-	-	1	2	-
Cu 2nd Cl.	-	10	-	-	2	-	80	-	2	3	4.5
	-	-	-	-	2	2	-	-	1	1	-
Cu 3rd Cl.	-	-	-	-	2	-	50	-	2	2	4.5
	-	-	-	-	-	2	-	-	1	1	-

Test No. 97 - Continued

Metallurgical Results

Product	Weight %	Assays, %		% Distribution	
		Cu	Zn	Cu	Zn
1. Cu Cleaner Conc.	5.36	27.5	2.77	83.1	4.1
2. Cu 3rd Cl. Tail.	1.17	10.9	12.3	7.2	3.9
3. Cu 2nd Cl. Tail.	1.51	2.96	12.7	2.5	5.3
4. Cu 1st Cl. Tail.	6.23	0.92	10.6	3.2	18.1
5. Cu Flot. Tail.	85.73	0.081	2.91	4.0	68.6
Head (Calculated)	100.00	1.77	3.63	100.0	100.0

Calculated Grades and Recoveries

Products 1 and 2	6.53	24.52	4.47	90.3	8.0
Products 1 to 3	8.04	20.47	6.02	92.8	13.3
Products 1 to 4	14.27	11.94	8.02	96.0	31.4

Test No. 98

Purpose: To repeat tests No. 91 to 93 but omit LS depressant additions and add a zinc circuit.

Procedure: Grind and float a lead rougher concentrate. Regrind the concentrate and clean four times. Combine lead rougher and 1st cleaner tailings, condition and float a zinc concentrate. Regrind the Zn concentrate and clean four times.

Feed: 2000 grams minus 10 mesh Composite No. 5.

Grind: 20 minutes at 65 % solids in the laboratory ball mill.

Conditions:

Stage	Reagents Added, grams per tonne					Time, minutes			pH
	Na_2CO_3	NaCN	343	MIBC	$Ca(OH)_2$	Grind	Cond.	Froth	
Primary Grind	3500	50	15	-	-	20	-	-	-
Pb Rougher	-	-	15	12.5	-	-	5	4	9.2
	-	-	10	2.5	-	-	1	3	-
	-	-	10	2.5	-	-	1	3	-
Pb Conc. Regr.	750	7.5	10	-	-	20	-	-	-
Pb 1st Cl.	-	-	10	2.5	-	-	1	3	9.6
	-	-	5	2.5	-	-	1	3	-
Pb 2nd Cl.	-	5	5	2.5	-	-	1	2	9.4
	-	-	5	2.5	-	-	1	3	-
Pb 3rd Cl.	-	-	-	2.5	50	-	1	2	10.0
	-	-	5	2.5	-	-	1	2	-
Pb 4th Cl.	-	-	2.5	2.5	25	-	1	3	10.1
Combine lead rougher and 1st cleaner tailings for zinc flotation.									

Stage	Pb Rougher	Pb Regrind	Pb Cleaners
Flotation Cell	1000 g D - 1	Rod Mill	500 g D - 1
Speed: r.p.m.	1800	-	1300
% Solids	33	-	-

Test No. 98 - Continued

Conditions:

Stage	Reagents Added, g/tonne				Time, minutes			pH
	$Ca(OH)_2$	$CuSO_4$	343	DF1012	Grind	Cond.	Froth	
Zn Circuit								
Condition	1000	-	-	-	-	5	-	-
	250	700	-	-	-	5	-	11.1
Zn Rougher	-	-	25	10	-	1	4	-
	-	-	20	2.5	-	1	4	-
	-	-	10	2.5	-	1	4	-
Zn Conc. Regr.	500	100	5	-	20	-	-	-
Zn 1st Cl.	-	-	5	2.5	-	1	5	11.5
	-	-	10	2.5	-	1	5	-
Zn 2nd Cl.	150	-	2.5	-	-	1	4	11.7
	-	-	5	1.0	-	1	4	-
Zn 3rd Cl.	150	-	2.5	-	-	1	3	11.8
	-	-	2.5	1.0	-	1	3	-
Zn 4th Cl.	200	-	2.5	1.0	-	1	5	11.9

Test No. 98 - Continued

Metallurgical Results

Product	Weight %	Assays, %		% Distribution	
		Pb	Zn	Pb	Zn
1. Pb Cleaner Conc.	8.77	51.0	6.82	88.0	9.1
2. Pb 4th Cl. Tail.	1.00	9.84	9.31	1.9	1.4
3. Pb 3rd Cl. Tail.	1.56	5.23	8.42	1.6	2.0
4. Pb 2nd Cl. Tail.	3.10	2.32	7.34	1.4	3.4
5. Zn Cleaner Conc.	12.05	0.55	42.8	1.3	78.2
6. Zn 4th Cl. Tail.	0.83	1.58	7.09	0.3	0.9
7. Zn 3rd Cl. Tail.	1.44	1.21	3.83	0.3	0.8
8. Zn 2nd Cl. Tail.	3.43	0.75	1.34	0.5	0.7
9. Zn 1st Cl. Tail.	24.29	0.25	0.32	1.2	1.2
10. Zn Rougher Tail.	43.53	0.40	0.33	3.5	2.3
Head (Calculated)	100.00	5.08	6.59	100.0	100.0

Calculated Grades and Recoveries

Products 1 and 2	9.77	46.79	7.07	89.9	10.5
Products 1 to 3	11.33	41.06	7.26	91.5	12.5
Products 1 to 4	14.43	32.74	7.27	92.9	15.9
Products 5 and 6	12.88	0.61	40.50	1.6	79.1
Products 5 to 7	14.32	0.67	36.81	1.9	79.9
Products 5 to 8	17.75	0.68	29.98	2.4	80.6
Products 5 to 9	42.04	0.43	12.84	3.6	81.8
Products 5 to 10	85.57	0.42	6.48	7.1	84.1

Test No. 99

Purpose: To repeat the conditions of test No. 94 but include zinc circuit.

Procedure: Similar to test No. 94.

Feed: 2000 grams minus 10 mesh Composite No. 1.

Grind: 23 minutes at 65 % solids in a laboratory ball mill.

Conditions:

Stage	Reagents Added, grams per tonne							Time, minutes			pH
	NH_4-OH	LS3	R350	Pine Oil	R343	MIBC	SO_2	Grind	Cond.	Froth	
Grinding	150	150	-	-	-	-	-	23	-	-	8.9
Aeration	50	-	-	-	-	-	-	-	10	-	9.0
Cu Rougher 1	-	-	2.5	5.0	-	-	-	-	5	2	-
Cu Rougher 2	-	-	0.5	2.5	-	-	-	-	1	2	-
Cu Rougher 3	-	-	0.5	2.5	-	-	-	-	1	3	-
Cu Regrind	-	20	-	-	-	-	100	10	-	-	-
Conditioning	-	-	-	-	-	-	800	-	15	-	4.5
Cu 1st Cl. 1	-	-	-	-	25	2	-	-	1	2	-
Cu 1st Cl. 2	-	-	-	-	5	2	-	-	1	2	-
Cu 2nd Cl. 1	-	-	-	-	2	-	80	-	3	3	4.5
	-	-	-	-	2	-	-	-	1	1	-
Cu 3rd Cl. 1	-	-	-	-	-	2	50	-	2	2	4.5
Cu 3rd Cl. 2	-	-	-	-	2	-	-	-	1	2	-

Test No. 99 - Continued

Conditions:

Stage	Reagents Added, grams per tonne					Time, minutes			pH
	NH_4OH	$CuSO_4$	LS-3	343	Pine Oil	Grind	Cond.	Froth	
Zinc Circuit	300	400	50	-	-	-	10	-	9.2
Zn Rougher	-	-	-	15	-	-	1	3	-
	-	-	-	5	-	-	1	3	-
Zn 1st Cl.	100	-	-	-	-	-	1	2	10.5
Zn 2nd Cl.	100	-	-	-	-	-	1	2	10.5
Zn 3rd Cl.	100	-	-	-	-	-	1	2	10.6

Metallurgical Results

Product	Weight %	Assays, %		% Distribution		
		Cu	Zn	Cu	Zn	Zn Circuit
1. Cu Cleaner Conc.	6.05	25.5	2.68	87.5	4.7	-
2. Cu 3rd Cl. Tail.	0.77	10.6	12.5	4.6	2.8	-
3. Cu 2nd Cl. Tail.	1.68	2.35	16.5	2.2	8.0	-
4. Zn Cleaner Conc.	5.02	0.65	54.2	1.8	80.0	93.8
5. Zn 3rd Cl. Tail.	0.21	1.63	9.23	0.2	0.4	0.7
6. Zn 2nd Cl. Tail.	0.82	1.40	3.53	0.6	0.7	1.0
7. Zn 1st Cl. Tail.	4.77	0.32	0.59	0.8	0.7	1.0
8. Zn Flot. Tail.	80.68	0.046	0.13	2.3	3.2	3.5
Head (Calculated)	100.00	1.76	3.44	100.0	100.0	-

Calculated Grades and Recoveries

Products 1 and 2	6.82	23.82	3.78	92.1	7.0	-
Products 1 to 3	8.50	19.58	6.30	94.3	15.0	-
Products 4 and 5	5.23	0.69	47.28	2.0	80.4	94.5
Products 4 to 6	6.05	0.77	45.77	2.6	81.1	95.5
Products 4 to 7	10.82	0.57	25.85	3.4	81.8	96.5
Products 4 to 8	91.5	0.11	3.17	5.7	85.0	100.0

Test No. 100

Purpose: To repeat test No. 92, but double the frother additions to 2nd and 3rd stages of Pb rougher and all cleaner stages, and float zinc at lower pH with less collector.

Procedure: As for test No. 98.

Feed: 2000 grams minus 10 mesh Composite No. 5.

Grind: 20 minutes at 65 % solids in the laboratory ball mill.

Conditions:

Stage	Reagents Added, grams per tonne						Time, minutes			pH
	Na_2CO_3	NaCN	LS-3B	343	MIBC	$Ca(OH)_2$	Grind	Cond.	Froth	
Primary Grind	3500	50	40	15	-	-	20	-	-	-
Pb Rougher	-	-	-	15	12.5	-	-	5	4	9.1
	-	-	-	10	5	-	-	1	3	-
	-	-	-	10	5	-	-	1	3	-
Pb Conc. Regr.	750	7.5	10	10	-	-	20	-	-	-
Pb 1st Cl.	-	-	-	10	5	-	-	1	3	9.5
	-	-	-	5	5	-	-	1	3	-
Pb 2nd Cl.	-	5	5	5	5	-	-	1	2	9.4
	-	-	-	5	5	-	-	1	3	-
Pb 3rd Cl.	-	-	5	-	5	50	-	1	2	9.9
	-	-	-	5	5	-	-	1	2	-
Pb 4th Cl.	-	-	5	2.5	5	25	-	1	3	10.0

Combine lead rougher and 1st cleaner tailings for zinc flotation.

Test No. 100 - Continued

Conditions:

Stage	Reagents Added, grams per tonne					Time, minutes			pH
	$Ca(OH)_2$	$CuSO_4$	343	DF-1012	LS3B	Grind	Cond.	Froth	
Zn Circuit									
Condition	1000	-	-	-	100	-	5	-	
	-	750	-	-	-	-	5	-	10.1
Zn Rougher	-	-	25	10	-	-	1	4	-
	-	-	5	2.5	-	-	1	4	-
	-	-	5	2.5	-	-	1	4	-
Zn Conc. Regr.	500	100	5	-	20	20	-	-	-
Zn 1st Cl.	-	-	5	2.5	-	-	1	5	11.2
	-	-	5	2.5	-	-	1	5	-
Zn 2nd Cl.	100	-	-	-	-	-	1	4	11.5
	-	-	5	1.0	-	-	1	4	-
Zn 3rd Cl.	100	-	-	-	-	-	1	3	11.7
	-	-	2.5	1.0	-	-	1	3	-
Zn 4th Cl.	150	-	-	1.0	-	-	1	5	11.9

Test No. 100 - Continued

Metallurgical Results

Product	Weight	Assays, %		% Distribution	
	%	Pb	Zn	Pb	Zn
1. Pb Cleaner Conc.	9.86	45.3	13.0	88.0	19.3
2. Pb 4th Cl. Tail.	0.73	10.7	8.76	1.5	1.0
3. Pb 3rd Cl. Tail.	1.00	6.16	6.83	1.2	1.0
4. Pb 2nd Cl. Tail.	2.06	2.63	2.89	1.1	0.9
5. Zn Cleaner Conc.	6.65	0.45	50.9	0.6	51.0
6. Zn 4th Cl. Tail.	0.97	1.34	25.6	0.3	3.7
7. Zn 3rd Cl. Tail.	0.93	1.64	4.76	0.3	0.7
8. Zn 2nd Cl. Tail.	1.79	1.24	1.85	0.4	0.5
9. Zn 1st Cl. Tail.	3.84	0.81	0.79	0.6	0.5
10. Zn Rougher Tail.	72.17	0.42	1.97	6.0	21.4
Head (Calculated)	100.00	5.08	6.64	100.0	100.0

Calculated Grades and Recoveries

Products 1 and 2	10.59	42.92	12.7	89.5	20.3
Products 1 to 3	11.59	39.74	12.2	90.7	21.3
Products 1 to 4	13.65	34.14	10.8	91.8	22.2
Products 5 and 6	7.62	0.56	47.7	0.9	54.7
Products 5 to 7	8.55	0.68	43.0	1.2	55.4
Products 5 to 8	10.34	0.78	35.9	1.6	55.9
Products 5 to 9	14.18	0.78	26.4	2.2	56.4
Products 5 to 10	86.35	0.48	5.98	8.2	77.8

Test No. 101

Purpose: To repeat test No. 92, but increase frother additions only slightly. In the zinc circuit, increase $CuSO_4$ to rougher, replace part of 343 with M-2030 and clean once before regrinding.

Procedure: As for test No. 98, but regrind Zn 1st cleaner concentrate.

Feed: 2000 grams minus 10 mesh Composite No. 5.

Grind: 20 minutes at 65 % solids in the lab ball mill.

Conditions:

Stage	Reagents Added, grams per tonne						Time, minutes			pH
	Na_2CO_3	NaCN	LS-3B	343	MIBC*	$Ca(OH)_2$	Grind	Cond.	Froth	
Primary Grind	3500	50	40	15	-	-	20	-	-	-
Pb Rougher	-	-	-	15	12.5	-	-	5	4	9.2
	-	-	-	10	2.5	-	-	1	3	-
	-	-	-	10	5.0	-	-	1	3	-
Pb Conc. Regr.	750	7.5	10	10	-	-	20	-	-	-
Pb 1st Cl.	-	-	-	10	5	-	-	1	3	9.4
	-	-	-	5	3	-	-	1	3	-
Pb 2nd Cl.	-	5	5	5	3	-	-	1	2	9.2
	-	-	-	5	3	-	-	1	3	-
Pb 3rd Cl.	-	-	5	-	3	50	-	1	2	10.0
	-	-	-	5	3	-	-	1	2	-
Pb 4th Cl.	-	-	5	2.5	3	25	-	1	3	10.0
Combine lead rougher and 1st cleaner tailings for zinc flotation.										

* MIBC added as 0.5 % solution

Test No. 101 - Continued

Conditions:

Stage	Reagents Added, grams per tonne						Time, minutes			pH
	$Ca(OH)_2$	$CuSO_4$	LS-3B	343	M2030	MIBC	Grind	Cond.	Froth	
Zinc Circuit										
Condition	1250	-	100	-	-	-	-	5	-	-
	250	1000	-	-	-	-	-	5	-	11.0
Zn Rougher	-	-	-	15	10	5	-	2	4	-
	-	-	-	5	5	-	-	1	4	-
	-	-	-	5	5	-	-	1	4	-
Zn 1st Cl.	100	-	10	-	2.5	-	-	1	4	11.4
	-	-	-	5	-	3	-	1	4	-
Zn 1st Cl. Conc. Regrind	500	100	20	-	5	-	20	-	-	-
Zn 2nd Cl.	-	-	-	2.5	-	-	-	1	4	11.5
	-	-	-	2.5	2.5	-	-	1	4	-
Zn 3rd Cl.	100	-	5	-	-	-	-	1	3	11.7
	-	-	-	-	2.5	-	-	1	3	-
Zn 4th Cl.	150	-	5	-	-	-	-	1	5	11.9

Test No. 101 - Continued

Metallurgical Results

Product	Weight	Assays, %		% Distribution	
	%	Pb	Zn	Pb	Zn
1. Pb Cleaner Conc.	6.79	60.4	5.01	81.8	5.1
2. Pb 4th Cl. Tail.	0.91	19.8	9.35	3.6	1.3
3. Pb 3rd Cl. Tail.	1.46	12.0	10.5	3.5	2.3
4. Pb 2nd Cl. Tail.	2.36	3.52	10.1	1.7	3.6
5. Zn Cleaner Conc.	11.44	0.66	47.4	1.5	80.8
6. Zn 4th Cl. Tail.	1.56	1.70	6.67	0.5	1.6
7. Zn 3rd Cl. Tail.	2.93	1.19	1.70	0.7	0.7
8. Zn 2nd Cl. Tail.	6.93	0.56	0.30	0.8	0.3
9. Zn 1st Cl. Tail.	32.98	0.31	0.25	2.0	1.2
10. Zn Rougher Tail.	32.64	0.60	0.65	3.9	3.1
Head (Calculated)	100.00	5.01	6.71	100.0	100.0

Calculated Grades and Recoveries

Products 1 and 2	7.70	55.6	5.52	85.4	6.4
Products 1 to 3	9.16	48.65	6.32	88.9	8.7
Products 1 to 4	11.52	39.41	7.09	90.6	12.3
Products 5 and 6	13.00	0.78	42.5	2.0	82.4
Products 5 to 7	15.93	0.86	35.0	2.7	83.1
Products 5 to 8	22.86	0.77	24.5	3.5	83.4
Products 5 to 9	55.84	0.50	10.17	5.5	84.6
Products 5 to 10	88.48	0.54	6.66	9.4	87.7

Test No. 102

Purpose: To repeat test No. 101, but omit depressant IS-3B. In the zinc circuit reduce $CuSO_4$ and M-2030 additions.

Procedure: As for test No. 98.

Feed: 2000 grams minus 10 mesh Composite No. 5.

Grind: 20 minutes at 65 % solids in the laboratory ball mill.

Conditions:

Stage	Reagents Added, g/tonne					Time, minutes			pH
	Na_2CO_3	NaCN	343	MIBC	$Ca(OH)_2$	Grind	Cond.	Froth	
Primary Grind	3500	50	15	-	-	20	-	-	-
Pb Rougher	-	-	15	12.5	-	-	5	4	9.1
	-	-	10	2.5	-	-	1	3	-
	-	-	10	5.0	-	-	1	3	-
Pb Conc. Regr.	750	7.5	10	-	-	20	-	-	-
Pb 1st Cl.	-	-	10	5	-	-	1	3	9.3
	-	-	5	3	-	-	1	3	-
Pb 2nd Cl.	-	5	5	3	-	-	1	2	9.2
	-	-	5	3	-	-	1	3	-
Pb 3rd Cl.	-	-	-	3	50	-	1	2	9.9
	-	-	5	3	-	-	1	2	-
Pb 4th Cl.	-	-	2.5	3	25	-	1	3	10.0
Combine lead rougher and 1st cleaner tailings for zinc flotation.									

Test No. 102 - Continued

Conditions:

Stage	Reagents Added, g/tonne					Time, minutes			pH
	$Ca(OH)_2$	$CuSO_4$	343	M2030	MIBC	Grind	Cond.	Froth	
Zinc Circuit									
Condition	1250	-	-	-	-	-	5	-	-
	-	750	-	-	-	-	5	-	11.0
Zn Rougher	-	-	15	5	5	-	2	4	-
	-	-	10	2.5	-	-	1	4	-
	-	-	5	2.5	-	-	1	4	-
Zn 1st Cl.	200	-	-	2.5	-	-	1	4	11.3
	-	-	5	-	3	-	1	4	-
Zn 1st Cl. Conc. Regrind	500	100	-	5	-	20	-	-	-
Zn 2nd Cl.	-	-	5	-	-	-	1	4	11.6
	-	-	5	-	-	-	1	4	-
Zn 3rd Cl.	100	-	2.5	-	-	-	1	3	11.8
	-	-	2.5	2.5	-	-	1	3	-
Zn 4th Cl.	150	-	-	-	-	-	1	5	-

Test No. 102 - Continued

Metallurgical Results

Product	Weight %	Assays, %		% Distribution	
		Pb	Zn	Pb	Zn
1. Pb Cleaner Conc.	8.22	52.0	5.96	84.6	7.2
2. Pb 4th Cl. Tail.	1.66	12.0	7.66	3.9	1.9
3. Pb 3rd Cl. Tail.	1.86	6.27	7.91	2.3	2.2
4. Pb 2nd Cl. Tail.	3.27	2.39	8.37	1.6	4.0
5. Zn Cleaner Conc.	10.95	0.57	48.1	1.2	77.9
6. Zn 4th Cl. Tail.	1.28	1.82	7.64	0.5	1.4
7. Zn 3rd Cl. Tail.	1.89	1.34	2.27	0.5	0.6
8. Zn 2nd Cl. Tail.	4.35	0.63	0.52	0.6	0.4
9. Zn 1st Cl. Tail.	45.97	0.23	0.49	2.1	3.3
10. Zn Rougher Tail.	20.55	0.67	0.37	2.7	1.1
Head (Calculated)	100.00	5.05	6.77	100.0	100.0

Calculated Grades and Recoveries

Products 1 and 2	9.88	45.3	6.25	88.5	9.1
Products 1 to 3	11.74	39.1	6.51	90.8	11.3
Products 1 to 4	15.01	31.1	6.91	92.4	15.3
Products 5 and 6	12.23	0.70	43.9	1.7	79.3
Products 5 to 7	14.12	0.79	38.3	2.2	79.9
Products 5 to 8	18.47	0.75	29.4	2.8	80.3
Products 5 to 9	64.44	0.38	8.78	4.9	83.6
Products 5 to 10	84.99	0.45	6.74	7.6	84.7

Test No. 103

Purpose: To repeat the lead circuit of test No. 101 and make minor changes in the zinc circuit to improve Zn cleaner concentrate grade.

Procedure: Grind and float a lead concentrate. Regrind the concentrate and clean four times. Combine the lead rougher and 1st cleaner tailings, condition and float a zinc concentrate. Regrind the zinc concentrate and clean four times.

Feed: 2000 grams minus 10 mesh Composite No. 5.

Grind: 20 minutes at 65 % solids in the laboratory ball mill.

Conditions:

Stage	Reagents Added, grams per tonne						Time, minutes			pH
	Na_2CO_3	NaCN	LS-3B	343	MIBC	$Ca(OH)_2$	Grind	Cond.	Froth	
Primary Grind	3500	25	40	15	-	-	20	-	-	-
Pb Rougher	-	-	-	15	12.5	-	-	5	4	9.2
	-	-	-	10	2.5	-	-	1	3	-
	-	-	-	10	5.0	-	-	1	3	-
Pb Conc. Regr.	750	7.5	10	10	-	-	20	-	-	-
Pb 1st Cl.	-	-	-	10	5	-	-	1	3	9.4
	-	-	-	5	5	-	-	1	3	-
Pb 2nd Cl.	-	5	5	5	3	-	-	1	2	9.2
	-	-	-	5	3	-	-	1	3	-
Pb 3rd Cl.	-	-	5	-	3	50	-	1	2	10.0
	-	-	-	5	3	-	-	1	2	-
Pb 4th Cl.	-	-	5	2.5	3	25	-	1	3	10.1
Combine lead rougher and 1st cleaner tailings for zinc flotation.										

Stage	Pb Rougher	Pb Regrind	Pb Cleaners
Flotation Cell	1000 g D - 1	Rod Mill	500 g D - 1
Speed: r.p.m.	1900	-	1350
% Solids	33	-	-

Test No. 103 - Continued

Conditions:

Stage	Reagents Added, grams per tonne						Time, minutes			pH
	$Ca(OH)_2$	$CuSO_4$	LS3B	A343	M2030	MIBC	Grind	Cond.	Froth	
Zinc Circuit										
Conditioning 1	1200	-	50	-	-	-	-	6	-	11.2
Conditioning 2	-	700	-	-	-	-	-	6	-	-
Zn Rougher 1	-	-	-	15	10	-	-	2	4	10.7
Zn Rougher 2	-	-	-	5	5	5	-	1	4	-
Zn Rougher 3	-	-	-	5	5	5	-	1	3	-
Zn Regrind	700	50	-	-	-	-	20	-	-	11.9
Conditioning	-	-	20	-	-	-	-	5	-	-
Zn 1st Cl. 1	-	-	-	5	-	-	-	1	3	-
Zn 1st Cl. 2	-	-	-	2	2	-	-	1	3	-
Zn 1st Cl. 3	-	-	-	-	2	2	-	1	3	-
Zn 2nd Cl. 1	150	-	-	-	-	-	-	3	3	11.8
Zn 2nd Cl. 2	-	-	-	-	2	2	-	1	4	-
Zn 3rd Cl. 1	150	-	-	-	-	-	-	3	3	11.9
Zn 3rd Cl. 2	-	-	-	-	2	2	-	1	3	-
Zn 4th Cl. 1	100	-	-	-	-	-	-	3	3	11.8
Zn 4th Cl. 2	-	-	-	-	-	-	-	1	3	-

Stage	Zn Rougher	Zn Cleaners	Zn Regrind
Flotation Cell	1000 g D - 1	500 g D - 1	Pebble Mill

Test No. 103 - Continued

Metallurgical Results

Product	Weight	Assays, %		% Distribution		
	%	Pb	Zn	Pb	Zn	Zn Circuit
1. Pb Cleaner Conc.	7.45	58.4	5.13	84.9	5.6	-
2. Pb 4th Cl. Tail.	1.00	15.5	9.44	3.0	1.4	-
3. Pb 3rd Cl. Tail.	1.67	9.60	9.84	3.1	2.4	-
4. Pb 2nd Cl. Tail.	2.61	2.61	10.4	1.3	4.0	-
5. Zn Cleaner Conc.	10.62	0.49	50.7	1.0	79.0	91.3
6. Zn 4th Cl. Tail.	1.30	1.79	14.0	0.5	2.7	3.1
7. Zn 3rd Cl. Tail.	1.20	1.93	7.61	0.5	1.3	1.5
8. Zn 2nd Cl. Tail.	2.23	1.23	1.59	0.5	0.5	0.6
9. Zn 1st Cl. Tail.	11.73	0.46	0.32	1.0	0.6	0.6
10. Zn Rougher Tail.	60.19	0.35	0.28	4.2	2.5	2.9
Head (Calculated)	100.00	5.12	6.81	100.0	100.0	100.0

Calculated Grades and Recoveries

Products 1 and 2	8.45	53.32	5.64	87.9	7.0	-
Products 1 to 3	10.12	46.11	6.33	91.0	9.4	-
Products 1 to 4	12.73	37.19	7.17	92.3	13.4	-
Products 5 and 6	11.92	0.63	46.70	1.5	81.7	94.4
Products 5 to 7	13.12	0.75	43.12	2.0	83.0	95.9
Products 5 to 8	15.35	0.82	37.09	2.5	83.5	96.5
Products 5 to 9	27.08	0.66	21.16	3.5	84.1	97.1
Products 5 to 10	87.27	0.45	6.76	7.7	86.6	100.0

Test No. 104

Purpose: To repeat test No. 103 to investigate reproducibility of results.

Procedure: As for test No. 103.

Feed: 2000 grams minus 10 mesh Composite No. 5.

Grind: 20 minutes at 65 % solids in the laboratory ball mill.

Conditions:

Stage	Reagents Added, grams per tonne						Time, minutes			pH
	Na_2CO_3	NaCN	LS-3B	343	MIBC	$Ca(OH)_2$	Grind	Cond.	Froth	
Primary Grind	3500	25	40	15	-	-	20	-	-	-
Pb Rougher	-	-	-	15	12.5	-	-	5	4	9.1
	-	-	-	10	2.5	-	-	1	3	-
	-	-	-	10	5.0	-	-	1	3	-
Pb Conc. Regr.	750	7.5	10	10	-	-	20	-	-	-
Pb 1st Cl.	-	-	-	10	5	-	-	1	3	9.4
	-	-	-	5	5	-	-	1	3	-
Pb 2nd Cl.	-	5	5	5	3	-	-	1	2	-
	-	-	-	5	3	-	-	1	3	-
Pb 3rd Cl.	-	-	5	-	3	50	-	1	2	10.0
	-	-	-	5	3	-	-	1	2	-
Pb 4th Cl.	-	-	5	2.5	3	25	-	1	3	10.1

Combine lead rougher and 1st cleaner tailings for zinc flotation.

Test No. 104 - Continued

Conditions:

Stage	Reagents Added, grams per tonne						Time, minutes			pH
	$Ca(OH)_2$	$CuSO_4$	LS-3B	A343	M2030	MIBC	Grind	Cond.	Froth	
Zinc Circuit										
Conditioning 1	1200	-	50	-	-	-	-	6	-	11.2
Conditinoing 2	-	700	-	-	-	-	-	6	-	10.7
Zn Rougher 1	-	-	-	15	10	-	-	2	4	-
Zn Rougher 2	-	-	-	5	5	5	-	1	3	-
Zn Rougher 3	-	-	-	5	5	5	-	1	3	-
Zn Regrind	700	50	-	-	-	-	20	-	-	-
Conditioning	-	-	20	-	-	-	-	5	-	11.9
Zn 1st Cl. 1	-	-	-	5	-	-	-	1	3	-
Zn 1st Cl. 2	-	-	-	2	2	-	-	1	3	-
Zn 1st Cl. 3	-	-	-	-	2	2	-	1	3	-
Zn 2nd Cl. 1	150	-	-	-	-	-	-	3	3	11.9
Zn 2nd Cl. 2	-	-	-	-	2	2	-	1	4	-
Zn 3rd Cl. 1	150	-	-	-	-	-	-	3	3	11.9
Zn 3rd Cl. 2	-	-	-	-	2	2	-	1	3	-
Zn 4th Cl. 1	100	-	-	-	-	-	-	3	3	11.8
Zn 4th Cl. 2	-	-	-	-	-	-	-	1	3	-

Test No. 104 - Continued

Metallurgical Results

Product	Weight %	Assays, % Pb	Assays, % Zn	% Distribution Pb	% Distribution Zn	% Distribution Zn Circuit
1. Pb Cleaner Conc.	6.76	60.8	4.62	80.8	4.7	-
2. Pb 4th Cl. Tail.	1.39	20.7	9.29	5.7	1.9	-
3. Pb 3rd Cl. Tail.	1.52	12.9	9.49	3.9	2.2	-
4. Pb 2nd Cl. Tail.	2.36	3.39	10.0	1.6	3.5	-
5. Zn Cleaner Conc.	10.15	0.40	50.0	0.8	75.9	86.5
6. Zn 4th Cl. Tail.	1.26	1.87	24.4	0.5	4.6	5.2
7. Zn 3rd Cl. Tail.	1.32	2.16	13.2	0.6	2.6	3.0
8. Zn 2nd Cl. Tail.	3.54	1.43	2.99	1.0	1.6	1.8
9. Zn 1st Cl. Tail.	7.35	0.68	0.60	1.0	0.7	0.8
10. Zn Rougher Tail.	64.35	0.34	0.25	4.1	2.3	2.7
Head (Calculated)	100.00	5.09	6.69	100.0	100.0	100.0

Calculated Grades and Recoveries

Products 1 and 2	8.15	53.96	5.42	86.5	6.6	-
Products 1 to 3	9.67	47.51	6.06	90.4	8.8	-
Products 1 to 4	12.03	38.85	6.83	92.0	12.3	-
Products 5 and 6	11.41	0.56	47.17	1.3	80.5	91.7
Products 5 to 7	12.73	0.73	43.65	1.9	83.1	94.7
Products 5 to 8	16.27	0.88	34.80	2.9	84.7	96.5
Products 5 to 9	23.62	0.82	24.16	3.9	85.4	97.3
Products 5 to 10	87.97	0.47	6.67	8.0	87.7	100.0

Test No. 105

Purpose: To repeat the conditions of test No. 99 in order to study reproducibility.

Procedure: As for test No. 99.

Feed: 2000 grams minus 10 mesh Composite No. 1 ore.

Grind: 23 minutes at 65 % solids in a laboratory ball mill.

Conditions:

Stage	Reagents Added, grams per tonne							Time, minutes			pH
	NH_4-OH	LS3	R350	Pine Oil	R343	MIBC	SO_2	Grind	Cond.	Froth	
Grinding	150	150	-	-	-	-	-	23	-	-	8.9
Aeration	50	-	-	-	-	-	-	-	10	-	-
Cu Ro. 1	-	-	2.5	5.0	-	-	-	-	5	2	-
Cu Ro. 2	-	-	0.5	2.5	-	-	-	-	1	2	-
Cu Ro. 3	-	-	0.5	2.5	-	-	-	-	1	3	-
Cu Regrind	-	20	-	-	-	-	100	10	-	-	-
Conditioning	-	-	-	-	-	-	800	-	15	-	4.5
Cu 1st Cl. 1	-	-	-	-	2.5	2	-	-	1	2	-
Cu 1st Cl. 2	-	-	-	-	5	2	-	-	1	2	-
Cu 2nd Cl. 1	-	-	-	-	2	-	80	-	3	3	4.5
Cu 2nd Cl. 2	-	-	-	-	2	2	-	-	1	1	-
Cu 3rd Cl. 1	-	-	-	-	-	-	50	-	2	2	-
Cu 3rd Cl. 2	-	-	-	-	2	2	-	-	1	2	-

Test No. 105 - Continued

Conditions:

Stage	Reagents Added, g/tonne					Time, minutes			pH
	NH_4OH	$CuSO_4$	LS-3	343	Pine Oil	Grind	Cond.	Froth	
Zinc Circuit									
Conditioning	200	400	50	-	-	-	10	-	-
Zn Ro. 1	-	-	-	15	-	-	1	3	-
Zn Ro. 2	-	-	-	5	-	-	1	3	-
Zn 1st Cl.	100	-	-	-	-	-	1	2	10.5
Zn 2nd Cl.	100	-	-	-	-	-	1	2	10.6
Zn 3rd Cl.	100	-	-	-	-	-	1	2	10.6

Metallurgical Results

Product	Weight %	Assays, %		% Distribution		
		Cu	Zn	Cu	Zn	Zn Circuit
1. Cu 3rd Cl. Conc.	5.69	27.6	2.58	88.2	4.0	-
2. Cu 3rd Cl. Tail.	0.42	9.54	15.5	2.2	1.8	-
3. Cu 2nd Cl. Tail.	1.67	3.64	13.5	3.4	6.2	-
4. Zn Cleaner Conc.	5.29	0.60	55.3	1.8	80.7	91.8
5. Zn 3rd Cl. Tail.	0.38	1.40	7.41	0.3	0.8	0.9
6. Zn 2nd Cl. Tail.	2.01	0.77	3.06	0.9	1.7	1.9
7. Zn 1st Cl. Tail.	6.10	0.32	0.77	1.1	1.3	1.5
8. Zn Flot. Tailing	78.46	0.047	0.16	2.1	3.5	3.9
Head (Calculated)	100.00	1.78	3.62	100.0	100.0	-

Calculated Grades and Recoveries

Products 1 and 2	6.11	26.36	3.46	90.4	5.8	-
Products 1 to 3	7.76	21.53	5.63	93.8	12.0	-
Products 4 and 5	5.67	0.65	52.09	2.1	81.5	92.7
Products 4 to 6	7.68	0.68	39.26	3.0	83.2	94.6
Products 4 to 7	13.78	0.52	22.22	4.1	84.5	96.1
Products 4 to 8	92.24	0.11	3.45	6.2	88.0	100.0

Test No. 106

Purpose: To repeat tests No. 103 and 104, but omit LS depressant.

Procedure: As for test No. 103.

Feed: 2000 grams minus 10 mesh Composite No. 5.

Grind: 20 minutes at 65 % solids in the laboratory ball mill.

Conditions:

Stage	Reagents Added, grams per tonne					Time, minutes			pH
	Na_2CO_3	NaCN	343	MIBC	$Ca(OH)_2$	Grind	Cond.	Froth	
Primary Grind	3500	50	15	-	-	20	-	-	-
Pb Rougher	-	-	15	12.5	-	-	5	4	9.2
	-	-	10	2.5	-	-	1	3	-
	-	-	10	5	-	-	1	3	-
Pb Conc. Regr.	750	7.5	10	-	-	20	-	-	-
Pb 1st Cl.	-	-	10	5	-	-	1	3	9.4
	-	-	5	5	-	-	1	3	-
Pb 2nd Cl.	-	5	5	3	-	-	1	2	9.3
	-	-	5	3	-	-	1	3	-
Pb 3rd Cl.	-	-	-	3	50	-	1	2	10.1
	-	-	5	3	-	-	1	2	-
Pb 4th Cl.	-	-	2.5	3	25	-	1	3	10.2
Combine lead rougher and 1st cleaner tailings for zinc flotation.									

Test No. 106 - Continued

Conditions:

Stage	Reagents Added, grams per tonne					Time, minutes			pH
	$Ca(OH)_2$	$CuSO_4$	A343	M2030	MIBC	Grind	Cond.	Froth	
Zinc Circuit									
Conditioning 1	1200	-	-	-	-	-	6	-	11.1
Conditioning 2	-	700	-	-	-	-	6	-	-
Zn Rougher 1	-	-	15	10	-	-	2	4	10.6
Zn Rougher 2	-	-	5	5	5	-	1	4	-
Zn Rougher 3	-	-	5	5	5	-	1	3	-
Zn Regrind	700	50	-	-	-	20	-	-	-
Conditioning	-	-	-	-	-	-	5	-	-
Zn 1st Cl. 1	-	-	5	-	-	-	1	3	11.8
Zn 1st Cl. 2	-	-	2	2	-	-	1	3	-
Zn 1st Cl. 3	-	-	-	2	2	-	1	3	-
Zn 2nd Cl. 1	150	-	-	-	-	-	3	3	11.9
Zn 2nd Cl. 2	-	-	-	2	2	-	1	4	-
Zn 3rd Cl. 1	150	-	-	-	-	-	3	3	11.9
Zn 3rd Cl. 2	-	-	-	2	2	-	1	3	-
Zn 4th Cl. 1	100	-	-	-	-	-	3	3	11.8
Zn 4th Cl. 2	-	-	-	-	-	-	1	3	-

Test No. 106 - Continued

Metallurgical Results

Product	Weight	Assays, %		% Distribution		
	%	Pb	Zn	Pb	Zn	Zn Circuit
1. Pb Cleaner Conc.	7.88	55.6	5.19	84.1	6.0	-
2. Pb 4th Cl. Tail.	1.26	14.6	8.26	3.5	1.5	-
3. Pb 3rd Cl. Tail.	1.88	8.39	8.52	3.0	2.4	-
4. Pb 2nd Cl. Tail.	3.01	2.59	9.14	1.5	4.1	-
5. Zn Cleaner Conc.	10.90	0.55	48.5	1.2	78.0	90.6
6. Zn 4th Cl. Tail.	0.82	1.93	17.6	0.3	2.1	2.5
7. Zn 3rd Cl. Tail.	1.41	1.59	9.83	0.4	2.0	2.4
8. Zn 2nd Cl. Tail.	2.50	1.31	3.46	0.6	1.3	1.5
9. Zn 1st Cl. Tail.	4.68	0.66	0.68	0.6	0.5	0.5
10. Zn Rougher Tail.	65.66	0.38	0.22	4.8	2.1	2.5
Head (Calculated)	100.00	5.21	6.78	100.0	100.0	-

Calculated Grades and Recoveries

Products 1 and 2	9.14	49.95	5.61	87.6	7.5	-
Products 1 to 3	11.02	42.86	6.11	90.6	9.9	-
Products 1 to 4	14.03	34.22	6.76	92.1	14.0	-
Products 5 and 6	11.72	0.65	46.34	1.5	80.1	93.1
Products 5 to 7	13.13	0.75	42.42	1.9	82.1	95.5
Products 5 to 8	15.63	0.84	36.19	2.5	83.4	97.0
Products 5 to 9	20.31	0.80	28.00	3.1	83.9	97.5
Products 5 to 10	85.97	0.48	6.78	7.9	86.0	100.0

Test No. 107

Purpose: To repeat test No. 106 exactly, to investigate reproducibility.

Procedure: As for test No. 103.

Feed: 2000 grams minus 10 mesh Composite No. 5.

Grind: 20 minutes at 65 % solids in the laboratory ball mill.

Conditions:

Stage	Reagents Added, grams per tonne					Time, minutes			pH
	Na_2CO_3	NaCN	343	MIBC	$Ca(OH)_2$	Grind	Cond.	Froth	
Primary Grind	3500	50	15	-	-	20	-	-	-
Pb Rougher	-	-	15	12.5	-	-	5	4	9.1
	-	-	10	2.5	-	-	1	3	-
	-	-	10	5	-	-	1	3	-
Pb Conc. Regr.	750	7.5	10	-	-	20	-	-	-
Pb 1st Cl.	-	-	10	5	-	-	1	3	9.3
	-	-	5	5	-	-	1	3	-
Pb 2nd Cl.	-	5	5	3	-	-	1	2	9.2
	-	-	5	3	-	-	1	3	-
Pb 3rd Cl.	-	-	-	3	50	-	1	2	10.0
	-	-	5	3	-	-	1	2	-
Pb 4th Cl.	-	-	2.5	3	25	-	1	3	10.1

Combine lead rougher and 1st cleaner tailings for zinc flotation.

Test No. 107 - Continued

Conditions:

Stage	Reagents Added, g/tonne					Time, minute			pH
	$Ca(OH)_2$	$CuSO_4$	A343	M2030	MIBC	Grind	Cond.	Froth	
Zinc Circuit									
Conditioning 1	1200	-	-	-	-	-	6	-	11.2
Conditioning 2	-	700	-	-	-	-	6	-	10.7
Zn Rougher 1	-	-	15	10	-	-	2	4	-
Zn Rougher 2	-	-	5	5	5	-	1	4	-
Zn Rougher 3	-	-	5	5	5	-	1	3	-
Zn Regrind	700	50	-	-	-	20	-	-	-
Conditioning	-	-	-	-	-	-	5	-	11.8
Zn 1st Cl. 1	-	-	5	-	-	-	1	3	-
Zn 1st Cl. 2	-	-	2	2	-	-	1	3	-
Zn 1st Cl. 3	-	-	-	2	2	-	1	3	-
Zn 2nd Cl. 1	150	-	-	-	-	-	3	3	11.9
Zn 2nd Cl. 2	-	-	-	2	2	-	1	4	-
Zn 3rd Cl. 1	150	-	-	-	-	-	3	3	11.8
Zn 3rd Cl. 2	-	-	-	2	2	-	1	3	-
Zn 4th Cl. 1	100	-	-	-	-	-	3	3	11.9
Zn 4th Cl. 2	-	-	-	-	-	-	1	3	-

Test No. 107 - Continued

Metallurgical Results

Product	Weight %	Assays, %		% Distribution		
		Pb	Zn	Pb	Zn	Zn Circuit
1. Pb Cleaner Conc.	7.43	57.4	4.95	83.3	5.5	-
2. Pb 4th Cl. Tail.	1.03	15.6	8.45	3.1	1.3	-
3. Pb 3rd Cl. Tail.	1.84	10.1	8.86	3.6	2.4	-
4. Pb 2nd Cl. Tail.	2.82	3.02	9.66	1.7	4.1	-
5. Zn Cleaner Conc.	10.12	0.42	51.4	0.9	77.4	89.3
6. Zn 4th Cl. Tail.	0.53	2.02	21.7	0.2	1.7	2.0
7. Zn 3rd Cl. Tail.	0.91	1.97	8.88	0.3	1.2	1.4
8. Zn 2nd Cl. Tail.	2.47	1.60	5.63	0.8	2.1	2.4
9. Zn 1st Cl. Tail.	4.97	0.95	1.22	0.9	0.9	1.0
10. Zn Rougher Tail.	67.88	0.39	0.34	5.2	3.4	3.9
Head (Calculated)	100.00	5.12	6.72	100.0	100.0	-

Calculated Grades and Recoveries

Products 1 and 2	8.46	52.31	5.38	86.4	6.8	-
Products 1 to 3	10.30	44.77	6.00	90.0	9.2	-
Products 1 to 4	13.12	35.80	6.79	91.7	13.3	-
Products 5 and 6	10.65	0.50	49.92	1.1	79.1	91.3
Products 5 to 7	11.56	0.62	46.69	1.4	80.3	92.7
Products 5 to 8	14.03	0.79	39.46	2.2	82.4	95.1
Products 5 to 9	19.00	0.83	29.46	3.1	83.3	96.1
Products 5 to 10	86.88	0.49	6.71	8.3	86.7	100.0

Test No. 108

Purpose: To repeat test No. 99, but replace LS3 with 60 g/t NaCN in the grind and increase collector additions to the copper rougher.

Procedure: As for test No. 94.

Feed: 2000 grams minus 10 mesh Composite No. 1.

Grind: 23 minutes at 65 % solids in the laboratory ball mill.

Conditions:

Stage	Reagents Added, grams per tonne							Time, minutes			pH
	NH_4-OH	NaCN	R350	Pine Oil	SO_2	R343	MIBC	Grind	Cond.	Froth	
Primary Grind	150	60	-	-	-	-	-	23	-	-	-
Aeration	50		-	-	-	-	-	-	10	-	9.0
Cu Rougher	-	-	5	5.0	-	-	-	-	5	2	-
	-	-	1	2.5	-	-	-	-	1	2	-
	-	-	1	2.5	-	-	-	-	1	3	-
Cu Conc. Regr.	-	-	-	-	100	-	-	10	-	-	-
Condition	-	-	-	-	850	-	-	-	15	-	4.5
Cu 1st Cl.	-	-	-	-	-	5.0	2	-	1	3	-
	-	-	-	-	-	5.0	2	-	1	2	-
Cu 2nd Cl.	-	-	-	-	85	2.0	-	-	3	3	4.5
	-	-	-	-	-	2.0	-	-	1	1	-
Cu 3rd Cl.	-	-	-	-	50	-	2	-	2	2	4.5
	-	-	-	-	-	2.0	-	-	1	1	-

Combine copper rougher and 1st cleaner tailings for zinc flotation.

Test No. 108 - Continued

Conditions:

Stage	Reagents Added, g/tonne				Time, minutes			pH
	NH_4OH	$CuSO_4$	343	MIBC	Grind	Cond.	Froth	
Zn Circuit								
Condition	300	400	-	-	-	10	-	9.4
Zn Rougher	-	-	15	10	-	1	3	-
	-	-	5	5	-	1	3	-
Zn 1st Cl.	100	-	-	2	-	1	3	10.0
Zn 2nd Cl.	100	-	-	2	-	1	2	10.0
Zn 3rd Cl.	100	-	-	2	-	1	2	10.1

Metallurgical Results

Product	Weight %	Assays, %		% Distribution		
		Cu	Zn	Cu	Zn	Zn Circuit
1. Cu Cleaner Conc.	5.80	27.3	4.02	88.0	6.4	-
2. Cu 3rd Cl. Tail.	0.041	4.57	16.6	1.0	1.9	-
3. Cu 2nd Cl. Tail.	1.18	1.97	13.8	1.3	4.4	-
4. Zn Cleaner Conc.	5.47	1.05	55.3	3.2	82.5	94.4
5. Zn 3rd Cl. Tail.	0.20	2.54	9.34	0.3	0.5	0.6
6. Zn 2nd Cl. Tail.	1.17	1.54	2.99	1.0	1.0	1.1
7. Zn 1st Cl. Tail.	16.55	0.31	0.25	2.8	1.1	1.3
8. Zn Rougher Tail.	69.22	0.061	0.12	2.4	2.2	2.6
Head (Calculated)	100.00	1.80	3.67	100.0	100.0	-

Calculated Grades and Recoveries

Products 1 and 2	6.21	25.8	4.85	89.0	8.3	-
Products 1 to 3	7.39	22.0	6.28	90.3	12.7	-
Products 4 and 5	5.67	1.10	53.68	3.5	83.0	95.0
Products 4 to 6	6.84	1.18	45.01	4.5	84.0	96.1
Products 4 to 7	23.39	0.56	13.34	7.3	85.1	97.4
Products 4 to 8	92.61	0.19	3.46	9.7	87.3	100.0

Test No. 109

Purpose: To repeat exactly test No. 108, to investigate reproducibility.

Procedure: As for test No. 94.

Feed: 2000 grams minus 10 mesh Composite No. 1.

Grind: 23 minutes at 65 % solids in the laboratory ball mill.

Conditions:

Stage	Reagents Added, grams per tonne							Time, minutes			pH
	NH_4-OH	NaCN	R350	Pine Oil	SO_2	R343	MIBC	Grind	Cond.	Froth	
Primary Grind	150	60	-	-	-	-	-	23	-	-	-
Aeration	50	-	-	-	-	-	-	-	10	-	9.0
Cu Rougher	-	-	5	5.0	-	-	-	-	5	2	-
	-	-	1	2.5	-	-	-	-	1	2	-
	-	-	1	2.5	-	-	-	-	1	3	-
Cu Conc. Regr.	-	-	-	-	100	-	-	10	-	-	-
Condition	-	-	-	-	900	-	-	-	15	-	4.5
Cu 1st Cl.	-	-	-	-	-	5.0	2	-	1	3	-
	-	-	-	-	-	5.0	2	-	1	2	-
Cu 2nd Cl.	-	-	-	-	85	2.0	-	-	3	3	4.5
	-	-	-	-	-	2.0	-	-	1	1	-
Cu 3rd Cl.	-	-	-	-	-	-	2	-	2	2	4.5
	-	-	-	-	-	2.0	-	-	1	1	-
Combine copper rougher and 1st cleaner tailings for zinc flotation.											

Test No. 109 - Continued

Conditions:

Stage	Reagents Added, g/tonne				Time, minutes			pH
	NH_4OH	$CuSO_4$	343	MIBC	Grind	Cond.	Froth	
Zn Circuit								
Condition	300	400	-	-	-	10	-	9.3
Zn Rougher	-	-	15	10	-	1	3	-
	-	-	5	5	-	1	3	-
Zn 1st Cl.	100	-	-	2	-	1	3	9.9
Zn 2nd Cl.	100	-	-	2	-	1	2	10.0
Zn 3rd Cl.	100	-	-	2	-	1	2	10.0

Metallurgical Results

Product	Weight %	Assays, %		% Distribution		
		Cu	Zn	Cu	Zn	Zn Circuit
1. Cu Cleaner Conc.	6.19	26.0	4.50	89.8	7.6	-
2. Cu 3rd Cl. Tail.	0.57	3.39	16.3	1.1	2.5	-
3. Cu 2nd Cl. Tail.	1.43	1.21	11.8	1.0	4.6	-
4. Zn Cleaner Conc.	5.41	0.93	54.7	2.8	80.6	94.4
5. Zn 3rd Cl. Tail.	0.21	1.51	7.08	0.2	0.4	0.5
6. Zn 2nd Cl. Tail.	1.10	1.32	2.89	0.8	0.9	1.0
7. Zn 1st Cl. Tail.	18.78	0.23	0.22	2.3	1.1	1.3
8. Zn Rougher Tail.	66.31	0.054	0.13	2.0	2.3	2.8
Head (Calculated)	100.00	1.79	3.67	100.0	100.0	-

Calculated Grades and Recoveries

Products 1 and 2	6.76	24.1	5.49	90.9	10.1	-
Products 1 to 3	8.19	20.1	6.59	91.9	14.7	-
Products 4 and 5	5.62	0.95	52.92	3.0	81.0	94.9
Products 4 to 6	6.72	1.01	44.73	3.8	81.9	95.9
Products 4 to 7	25.50	0.44	11.95	6.1	83.0	97.2
Products 4 to 8	91.81	0.16	3.41	8.1	85.3	100.0

Test No. 110

Purpose:	To investigate the effect of omitting all depressants on the flotation of copper and zinc.
Procedure:	As for test No. 94.
Feed:	2000 grams minus 10 mesh Composite No. 1.
Grind:	23 minutes at 65 % solids in the laboratory ball mill.

Conditions:

Stage	Reagents Added, grams per tonne						Time, minutes			pH
	NH_4-OH	R350	Pine Oil	SO_2	R343	MIBC	Grind	Cond.	Froth	
Primary Grind	150	-	-	-	-	-	23	-	-	-
Aeration	50	-	-	-	-	-	-	10	-	-
Cu Rougher	-	2.5	5.0	-	-	-	-	5	2	9.0
	-	0.5	2.5	-	-	-	-	1	2	-
	-	0.5	2.5	-	-	-	-	1	3	-
Cu Regrind	-	-	-	100	-	-	10	-	-	-
Condition	-	-	-	800	-	-	-	15	-	4.5
Cu 1st Cl.	-	-	-	-	5	2	-	1	2	-
	-	-	-	-	5	2	-	1	2	-
Cu 2nd Cl.	-	-	-	75	2	-	-	3	3	4.5
	-	-	-	-	2	-	-	1	1	-
Cu 3rd Cl.	-	-	-	50	-	2	-	2	2	4.5
	-	-	-	-	2	-	-	1	1	-
Combine copper rougher and 1st cleaner tailings for zinc flotation.										

Test No. 110 - Continued

Conditions:

Stage	Reagents Added, g/tonne				Time, minutes			pH
	NH_4OH	$CuSO_4$	343	MIBC	Grind	Cond.	Froth	
Zn Circuit								
Condition	300	400	-	-	-	10	-	9.3
Zn Rougher	-	-	15	10	-	1	3	-
	-	-	5	5	-	1	3	-
Zn 1st Cl.	100	-	-	2	-	1	3	9.9
Zn 2nd Cl.	100	-	-	2	-	1	2	10.0
Zn 3rd Cl.	100	-	-	2	-	1	2	10.0

Metallurgical Results

Product	Weight %	Assays, %		% Distribution		
		Cu	Zn	Cu	Zn	Zn Circuit
1. Cu Cleaner Conc.	8.11	20.2	5.65	91.4	12.7	-
2. Cu 3rd Cl. Tail.	1.02	2.89	21.9	1.6	6.2	-
3. Cu 2nd Cl. Tail.	1.46	1.44	19.1	1.3	7.7	-
4. Zn Cleaner Conc.	4.56	0.63	54.1	1.6	68.7	93.5
5. Zn 3rd Cl. Tail.	0.28	1.52	6.71	0.2	0.5	0.7
6. Zn 2nd Cl. Tail.	0.92	0.99	2.43	0.5	0.6	0.8
7. Zn 1st Cl. Tail.	17.39	0.20	0.30	1.9	1.4	2.0
8. Zn Rougher Tail	66.26	0.040	0.12	1.5	2.2	3.0
Head (Calculated)	100.00	1.79	3.60	100.0	100.0	-

Calculated Grades and Recoveries

Products 1 and 2	9.13	18.27	7.47	93.0	18.9	-
Products 1 to 3	10.59	15.95	9.07	94.3	26.6	-
Products 4 and 5	4.84	0.68	51.36	1.8	69.2	94.2
Products 4 to 6	5.76	0.73	43.55	2.3	69.8	95.0
Products 4 to 7	23.15	0.33	11.06	4.2	71.2	97.0
Products 4 to 8	89.41	0.11	2.95	5.7	73.4	100.0

Test No. 111

Purpose: To repeat test No. 110 exactly to investigate reproducibility.

Procedure: As for test No. 94.

Feed: 2000 grams minus 10 mesh Composite No. 1.

Grind: 23 minutes at 65 % solids in the laboratory ball mill.

Conditions:

Stage	Reagents Added, grams per tonne						Time, minutes			pH
	NH_4-OH	R350	Pine Oil	SO_2	R343	MIBC	Grind	Cond.	Froth	
Primary Grind	150	-	-	-	-	-	23	-	-	-
Aeration	50	-	-	-	-	-	-	10	-	8.9
Cu Rougher	-	2.5	5.0	-	-	-	-	5	2	-
	-	0.5	2.5	-	-	-	-	1	2	-
	-	0.5	2.5	-	-	-	-	1	3	-
Cu Regrind	-	-	-	100	-	-	10	-	-	-
Condition	-	-	-	800	-	-	-	15	-	4.5
Cu 1st Cl.	-	-	-	-	5	2	-	1	2	-
	-	-	-	-	5	2	-	1	2	-
Cu 2nd Cl.	-	-	-	80	2	-	-	3	3	4.5
	-	-	-	-	2	-	-	1	1	-
Cu 3rd Cl.	-	-	-	50	-	2	-	2	2	4.5
	-	-	-	-	2	-	-	1	1	-

Test No. 111 - Continued

Conditions:

Stage	Reagents Added, g/tonne				Time, minutes			pH
	NH_4OH	$CuSO_4$	343	MIBC	Grind	Cond.	Froth	
Zn Circuit								
Condition	300	400	-	-	-	10	-	9.4
Zn Rougher	-	-	15	10	-	1	3	-
	-	-	5	5	-	1	3	-
Zn 1st Cl.	100	-	-	2	-	1	3	9.9
Zn 2nd Cl.	100	-	-	2	-	1	2	10.0
Zn 3rd Cl.	100	-	-	2	-	1	2	10.1

Metallurgical Results

Product	Weight %	Assays, %		% Distribution		
		Cu	Zn	Cu	Zn	Zn Circuit
1. Cu Cleaner Conc.	8.30	20.0	5.72	92.2	13.1	-
2. Cu 3rd Cl. Tail.	0.73	3.96	18.7	1.6	3.8	-
3. Cu 2nd Cl. Tail.	1.68	1.60	18.3	1.5	8.5	-
4. Zn Cleaner Conc.	4.65	0.57	53.7	1.5	69.2	92.8
5. Zn 3rd Cl. Tail.	0.30	1.85	9.63	0.3	0.8	1.1
6. Zn 2nd Cl. Tail.	0.82	0.94	2.94	0.4	0.7	0.9
7. Zn 1st Cl. Tail.	5.38	0.31	0.75	0.9	1.1	1.5
8. Zn Rougher Tail.	78.14	0.037	0.13	1.6	2.8	3.7
Head (Calculated)	100.00	1.80	3.61	100.0	100.0	-

Calculated Grades and Recoveries

Products 1 and 2	9.03	18.7	6.77	93.8	16.9	-
Products 1 to 3	10.71	16.0	8.58	95.3	25.4	-
Products 4 and 5	4.95	0.65	51.03	1.8	70.0	93.9
Products 4 to 6	5.77	0.69	44.19	2.2	70.7	94.8
Products 4 to 7	11.15	0.51	23.23	3.1	71.8	96.3
Products 4 to 8	89.29	0.10	3.01	4.7	74.6	100.0

Test No. 112

Purpose: To repeat tests No. 108 and 109, but slightly reduce collector additions to the copper cleaners to produce a higher grade Cu concentrate.

Procedure: As for test No. 94.

Feed: 2000 grams minus 10 mesh Composite No. 1.

Grind: 23 minutes at 65 % solids in the laboratory ball mill.

Conditions:

Stage	Reagents Added, grams per tonne							Time, minutes			pH
	NH_4-OH	NaCN	R350	Pine Oil	SO_2	R343	MIBC	Grind	Cond.	Froth	
Primary Grind	150	60	-	-	-	-	-	23	-	-	-
Aeration	50	-	-	-	-	-	-	-	10	-	9.2
Cu Rougher	-	-	5	5.0	-	-	-	-	5	2	-
	-	-	1	2.5	-	-	-	-	1	2	-
	-	-	1	2.5	-	-	-	-	1	3	-
Cu Conc. Regr.	-	-	-	-	100	-	-	10	-	-	-
Condition	-	-	-	-	900	-	-	-	15	-	-
Cu 1st Cl.	-	-	-	-	-	2.5	2	-	1	2	4.5
	-	-	-	-	-	5.0	2	-	1	2	-
Cu 2nd Cl.	-	-	-	-	85	2.0	-	-	3	3	4.5
	-	-	-	-	-	2.0	2	-	1	1	-
Cu 3rd Cl.	-	-	-	-	50	-	2	-	2	2	4.5
	-	-	-	-	-	2.5	-	-	1	1	-

Combine copper rougher and 1st cleaner tailings for zinc flotation.

Test No. 112 - Continued

Conditions:

Stage	Reagents Added, g/tonne				Time, minutes			pH
	NH_4OH	$CuSO_4$	343	MIBC	Grind	Cond.	Froth	
Zn Circuit								
Condition	300	400	-	-	-	10	-	9.3
Zn Rougher	-	-	15	10	-	1	3	-
	-	-	5	5	-	1	3	-
Zn 1st Cl.	100	-	-	2	-	1	3	9.8
Zn 2nd Cl.	100	-	-	2	-	1	2	9.9
Zn 3rd Cl.	100	-	-	2	-	1	2	10.0

Metallurgical Results

Product	Weight %	Assays, %		% Distribution	
		Cu	Zn	Cu	Zn
1. Cu Cleaner Conc.	5.56	27.9	3.56	85.7	5.4
2. Cu 3rd Cl. Tail.	0.38	6.64	17.8	1.4	1.7
3. Cu 2nd Cl. Tail.	1.01	2.84	16.2	1.6	4.5
4. Zn Cleaner Conc.	5.33	1.48	55.4	5.2	81.2
5. Zn 3rd Cl. Tail.	0.30	4.06	21.2	0.7	1.7
6. Zn 2nd Cl. Tail.	0.73	1.87	4.70	0.7	0.9
7. Zn 1st Cl. Tail.	15.26	0.36	0.40	3.0	1.7
8. Zn Rougher Tail.	71.43	0.041	0.14	1.7	2.8
Head (Calculated)	100.00	1.81	3.63	100.0	100.0

Calculated Grades and Recoveries

Products 1 and 2	5.94	26.54	4.38	87.1	7.1
Products 1 to 3	6.95	23.09	7.00	88.7	11.6
Products 4 and 5	5.63	1.90	53.58	5.9	82.9
Products 4 to 6	6.36	1.90	47.97	6.6	83.8
Products 4 to 7	21.62	0.81	14.39	9.6	85.5
Products 4 to 8	93.05	0.22	3.45	11.3	88.4

Test No. 113

Purpose: To repeat test No. 112 exactly to investigate reproducibility.

Procedure: As for test No. 94.

Feed: 2000 grams minus 10 mesh Composite No. 1.

Grind: 23 minutes at 65 % solids in the laboratory ball mill.

Conditions:

Stage	Reagents Added, grams per tonne							Time, minutes			pH
	NH_4-OH	NaCN	R350	Pine Oil	SO_2	R343	MIBC	Grind	Cond.	Froth	
Primary Grind	150	60	-	-	-	-	-	23	-	-	-
Aeration	50	-	-	-	-	-	-	-	10	-	9.2
Cu Rougher	-	-	5	5.0	-	-	-	-	5	2	-
	-	-	1	2.5	-	-	-	-	1	2	-
	-	-	1	2.5	-	-	-	-	1	3	-
Cu Conc. Regr.	-	-	-	-	100	-	-	10	-	-	-
Condition	-	-	-	-	850	-	-	-	15	-	-
Cu 1st Cl.	-	-	-	-	-	2.5	2	-	1	2	4.5
	-	-	-	-	-	5.0	2	-	1	2	-
Cu 2nd Cl.	-	-	-	-	90	2.0	-	-	3	3	4.5
	-	-	-	-	-	2.0	2	-	1	1	-
Cu 3rd Cl.	-	-	-	-	50	-	2	-	2	2	4.5
	-	-	-	-	-	2.0	-	-	1	1	-

Combine copper rougher and 1st cleaner tailings for zinc flotation.

Test No. 113 - Continued

Conditions:

Stage	Reagents Added, g/tonne				Time, minutes			pH
	NH_4OH	$CuSO_4$	343	MIBC	Grind	Cond.	Froth	
Zn Circuit								
Condition	300	400	-	-	-	10	-	9.3
Zn Rougher	-	-	15	10	-	1	3	-
	-	-	5	5	-	1	3	-
Zn 1st Cl.	100	-	-	2	-	1	3	9.9
Zn 2nd Cl.	100	-	-	2	-	1	2	9.9
Zn 3rd Cl.	100	-	-	2	-	1	2	10.0

Metallurgical Results

Product	Weight %	Assays, %		% Distribution	
		Cu	Zn	Cu	Zn
1. Cu Cleaner Conc.	5.31	27.9	3.50	85.4	5.4
2. Cu 3rd Cl. Tail.	0.46	7.15	16.8	1.9	2.2
3. Cu 2nd Cl. Tail.	1.10	2.38	13.9	1.5	4.4
4. Zn Cleaner Conc.	5.25	1.48	54.5	4.5	82.9
5. Zn 3rd Cl. Tail.	0.24	2.51	11.3	0.3	0.8
6. Zn 2nd Cl. Tail.	1.74	1.35	3.31	0.6	0.7
7. Zn 1st Cl. Tail.	20.17	0.33	0.24	3.8	1.4
8. Zn Rougher Tail.	66.73	0.05	0.11	2.0	2.2
Head (Calculated)	100.00	1.73	3.45	100.0	100.0

Calculated Grades and Recoveries

Products 1 and 2	5.77	26.25	4.56	87.3	7.6
Products 1 to 3	6.87	22.43	6.05	88.8	12.0
Products 4 and 5	5.49	1.52	52.61	4.8	83.7
Products 4 to 6	6.23	1.50	46.75	5.4	84.4
Products 4 to 7	26.40	0.65	11.21	9.2	85.8
Products 4 to 8	93.13	0.21	3.26	11.2	88.0

Test No. 114

Purpose: To repeat the bulk rougher and cleaner conditions of test No. 71 and add Cu-Pb separation and Pb upgrading stages.

Procedure: Grind, aerate and float a Cu-Pb bulk concentrate. Regrind the concentrate and clean three times. Condition the Cu-Pb concentrate and float copper. Clean the copper concentrate twice. Heat the Cu flotation tailing and float pyrite. Clean the pyrite concentrate twice. (see flowsheet).

Feed: 2000 grams minus 10 mesh Composite No. 4.

Grind: 40 minutes at 66 % solids in the laboratory ball mill.

Conditions:

Stage	Reagents Added, g/tonne					Time, minutes			pH
	Na_2-CO_3	LS-3	343/ 350	241	MIBC	Grind	Cond.	Froth	
Primary Grind	3000	150	-	-	-	40	-	-	-
Aeration	1500	-	-	-	-	-	30	-	9.2
Cu-Pb Rougher	500	-	10	10	10	-	1	2	-
	200	-	10	10	-	-	1	2	9.2
	250	-	10	10	-	-	1	2	-
	250	-	10	10	-	-	1	2	-
Conc. Regr.	500	30	-	-	-	15	-	-	-
Cu-Pb 1st Cl.	450	-	2.5	-	2.5	-	1	3	9.6
	-	-	2.5	-	2.5	-	1	3	-
Cu-Pb 2nd Cl.	250	15	-	-	-	-	1	2	9.6
	-	-	2	-	2	-	1	3	-
Cu-Pb 3rd Cl.	250	15	-	-	2	-	1	4	9.6

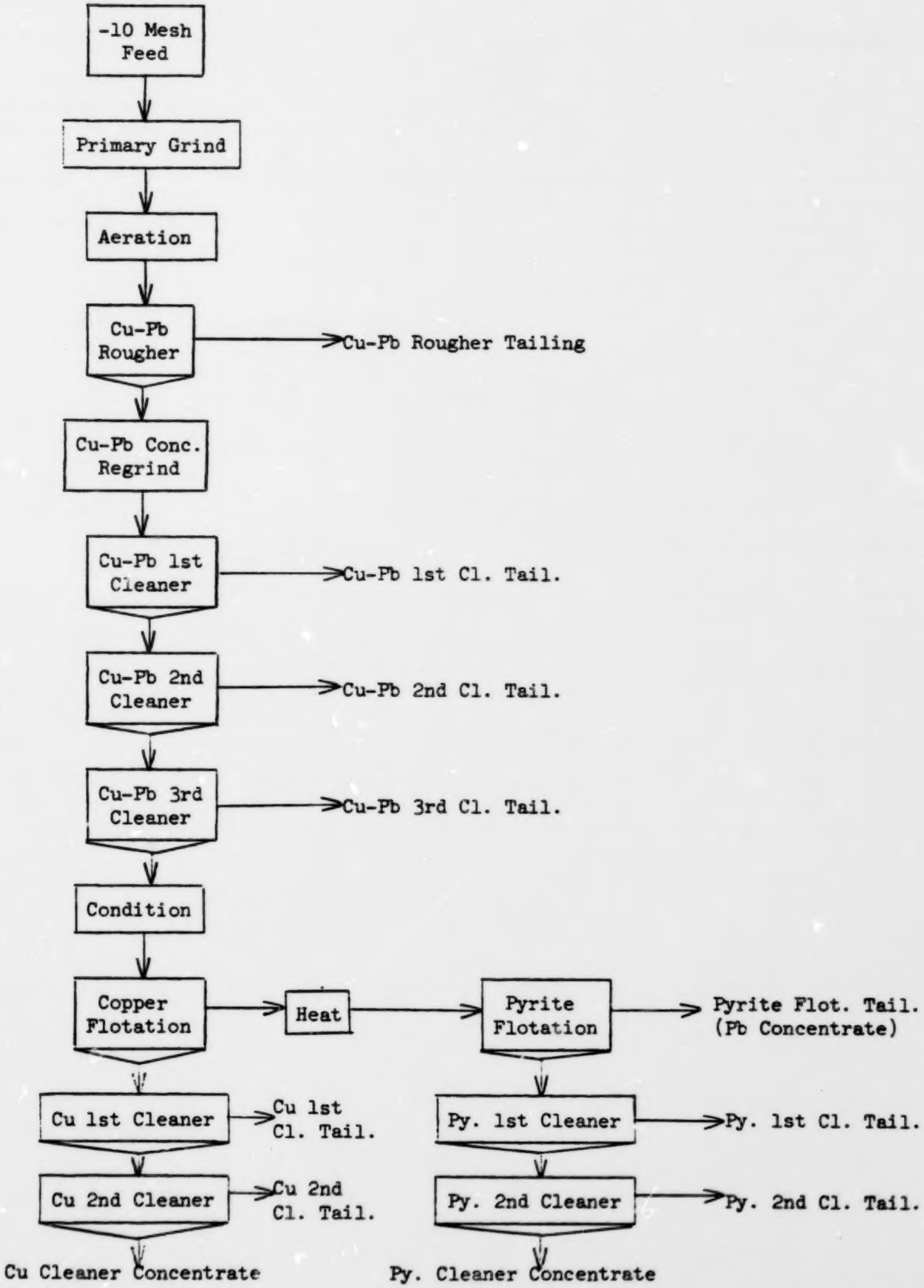
Test No. 114 - Continued

Conditions:

Stage	Reagents Added, grams per tonne							Time, minutes			pH
	Na_2-CO_3	A.C.	SO_2	Guar H-31	M2030	MIBC	A343	Grind	Cond.	Froth	
Cu-Pb Separation											
Conditioning 1	200	-	-	200	-	-	-	-	5	-	9.5
Conditioning 2	-	450	900	-	-	-	-	-	5	-	4.5
Conditioning 3	-	-	-	-	10	-	-	-	5	-	4.5
Cu Rougher 1	-	-	-	-	-	-	-	-	1	3	-
Cu Rougher 2	-	-	-	-	10	2	-	-	1	2	-
Cu 1st Cl.	-	-	100	20	-	-	-	-	3	2	4.5
	-	-	-	-	-	2	-	-	1	2	-
Cu 2nd Cl.	-	-	80	10	-	-	-	-	3	2	4.5
	-	-	-	-	-	-	-	-	1	1	-
Pb Upgrading											
Heat(85°C)	-	-	-	-	-	-	-	-	10	-	-
Pyrite Ro. 1	-	-	-	-	-	5	10	-	1	3	-
Pyrite Ro. 2	-	-	-	-	-	5	5	-	1	2	-
Pyrite 1st Cl. 1	-	-	-	-	-	2	-	-	1	2	-
Pyrite 1st Cl. 2	-	-	-	-	-	2	-	-	1	3	-
Pyrite 2nd Cl. 1	-	-	-	-	-	-	-	-	2	3	-
Pyrite 2nd Cl. 2	-	-	-	-	-	2	-	-	1	3	-

Test No. 114 - Continued

Flowsheet


-10 Mesh Feed
Primary Grind
Aeration
Cu-Pb Rougher
Cu-Pb Rougher Tailing
Cu-Pb Conc. Regrind
Cu-Pb 1st Cleaner
Cu-Pb 1st Cl. Tail.
Cu-Pb 2nd Cleaner
Cu-Pb 2nd Cl. Tail.
Cu-Pb 3rd Cleaner
Cu-Pb 3rd Cl. Tail.
Condition
Copper Flotation
Heat
Pyrite Flotation
Pyrite Flot. Tail. (Pb Concentrate)
Cu 1st Cleaner
Cu 1st Cl. Tail.
Py. 1st Cleaner
Py. 1st Cl. Tail.
Cu 2nd Cleaner
Cu 2nd Cl. Tail.
Py. 2nd Cleaner
Py. 2nd Cl. Tail.
Cu Cleaner Concentrate
Py. Cleaner Concentrate

Test No. 114 - Continued

Metallurgical Results

Product	Weight %	Assays, %			% Distribution		
		Cu	Pb	Zn	Cu	Pb	Zn
1. Cu Cleaner Concentrate	1.19	18.6	3.07	4.04	67.2	1.1	0.6
2. Cu 2nd Cleaner Tail.	0.22	4.72	9.16	10.4	3.2	0.6	0.3
3. Cu 1st Cleaner Tail.	0.68	2.22	14.6	10.4	4.6	3.1	0.8
4. Py. Flot. Tail.(Pb Conc.)	3.98	0.30	41.3	21.1	3.6	50.8	9.9
5. Py. 1st Cleaner Tail.	0.26	0.40	22.4	11.5	0.3	1.8	0.3
6. Py. 2nd Cleaner Tail.	0.30	0.33	19.2	10.5	0.3	1.8	0.4
7. Py. Cleaner Conc.	7.93	0.11	4.42	1.89	2.6	10.8	1.8
8. Cu-Pb 3rd Cl. Tail.	4.19	0.19	3.14	8.43	2.4	4.1	4.2
9. Cu-Pb 2nd Cl. Tail.	6.35	0.17	2.38	9.65	3.3	4.7	7.2
10. Cu-Pb 1st Cl. Tail.	11.58	0.099	1.70	11.5	3.5	6.1	15.6
11. Cu-Pb Rougher Tail.	63.32	0.047	0.77	7.90	9.0	15.1	58.9
Head (Calculated)	100.00	0.33	3.23	8.49	100.0	100.0	100.0

Calculated Grades and Recoveries

Products 1 and 2	1.41	16.43	4.02	5.04	70.4	1.7	0.9
Products 1 to 3	2.09	11.81	7.46	6.78	75.0	4.8	1.7
Products 4 and 5	4.24	0.30	40.14	20.5	3.9	52.6	10.2
Products 4 to 6	4.54	0.31	38.76	19.9	4.2	54.4	10.6
Products 4 to 7	12.47	0.18	16.92	8.43	6.8	65.2	12.4
Products 1 to 7	14.56	1.85	15.56	8.19	81.8	70.0	14.1
Products 1 to 8	18.75	1.48	12.79	8.25	84.2	74.1	18.3
Products 1 to 9	25.10	1.15	10.15	8.60	87.5	78.8	25.5
Products 1 to 10	36.68	0.82	7.49	9.52	91.0	84.9	41.1

Test No. 115

Purpose: To repeat test No. 114, but omit the the LS-3 depressant from bulk rougher and cleaners.

Procedure: As for test No. 114, but add a zinc flotation stage from the pyrite flotation tailing. Clean the zinc concentrate once.

Feed: 2000 grams minus 10 mesh Composite No. 4.

Grind: 40 minutes at 66 % solids in the laboratory ball mill.

Conditions:

Stage	Reagents Added, g/tonne				Time, minutes			pH
	Na_2CO_3	343/350	241	MIBC	Grind	Cond.	Froth	
Primary Grind	3000	-	-	-	40	-	-	-
Aeration	1500	-	-	-	-	30	-	9.2
Cu-Pb Rougher	-	10	10	10	-	1	2	-
	200	10	10	-	-	1	2	9.2
	250	10	10	-	-	1	2	-
	250	10	10	-	-	1	2	-
Conc. Regrind	500	-	-	-	15	-	-	-
Cu-Pb 1st Cl.	450	2.5	-	2.5	-	1	3	9.6
	-	2.5	-	2.5	-	1	3	-
Cu-Pb 2nd Cl.	250	-	-	-	-	1	2	9.6
	-	2	-	2	-	1	3	-
Cu-Pb 3rd Cl.	250	-	-	2	-	1	4	9.6

Test No. 115 - Continued

Conditions:

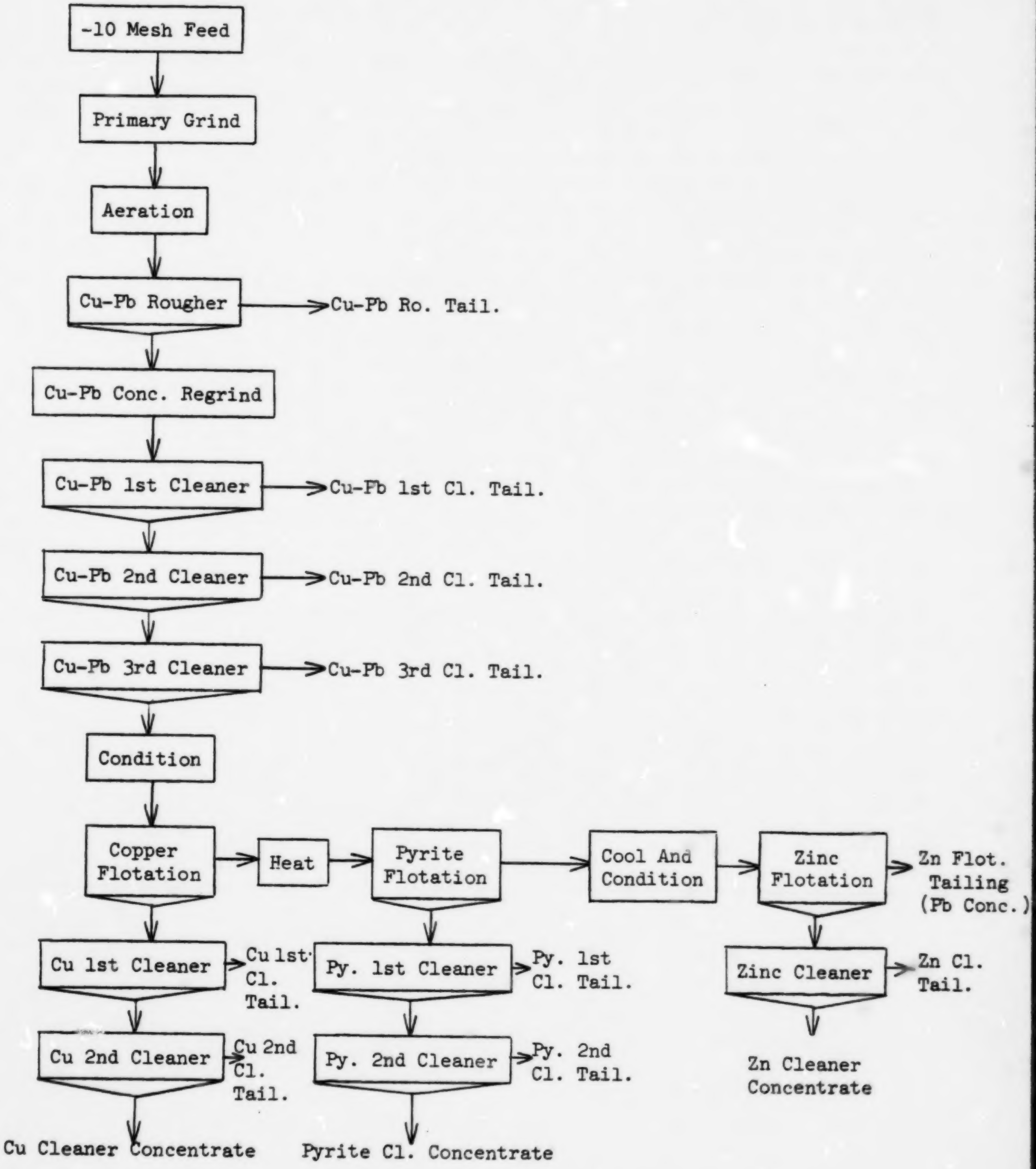
Stage	Reagents Added, grams per tonne							Time, minutes			pH
	Na_2-CO_3	A.C.	SO_2	Guar H-31	M2030	MIBC	A343	Grind	Cond.	Froth	
Cu-Pb Separation											
Conditioning 1	200	-	-	200	-	-	-	-	5	-	9.5
Conditioning 2	-	450	900	-	-	-	-	-	5	-	4.5
Conditioning 3	-	-	-	-	10	-	-	-	5	-	4.5
Cu Rougher 1	-	-	-	-	-	-	-	-	1	3	-
Cu Rougher 2	-	-	-	-	10	2	-	-	1	2	-
Cu 1st Cleaner	-	-	100	20	-	-	-	-	3	2	4.5
	-	-	-	-	-	2	-	-	1	2	-
Cu 2nd Cleaner	-	-	80	10	-	-	-	-	3	2	4.5
	-	-	-	-	-	2	-	-	1	1	-
Pb Upgrading											
Heat(85°C)	-	-	-	-	-	-	-	-	10	-	-
Pyrite Ro. 1	-	-	-	-	-	5	10	-	1	3	-
Pyrite Ro. 2	-	-	-	-	-	5	5	-	1	2	-
Py. 1st Cl. 1	-	-	-	-	-	2	-	-	1	2	-
Py. 1st Cl. 2	-	-	-	-	-	2	-	-	1	2	-
Py. 2nd Cl. 1	-	-	-	-	-	-	-	-	2	2	-
Py. 2nd Cl. 2	-	-	-	-	-	2	-	-	1	1	-

Conditions:

Stage	Reagents Added, grams per tonne			Time, minutes			pH
	CaO	$CuSO_4$	A343	Grind	Cond.	Froth	
Pb Conc. Dezincing							
Cooling(30°C)	200	-	-	-	10	-	10.5
Conditioning	-	100	-	-	10	-	-
Zn Rougher 1	-	-	5	-	1	3	-
Zn Rougher 2	-	-	2	-	1	3	-
Zn Cleaner	100	-	-	-	2	3	11.0

Test No. 115 - Continued

Flowsheet


-10 Mesh Feed
Primary Grind
Aeration
Cu-Pb Rougher
Cu-Pb Ro. Tail.
Cu-Pb Conc. Regrind
Cu-Pb 1st Cleaner
Cu-Pb 1st Cl. Tail.
Cu-Pb 2nd Cleaner
Cu-Pb 2nd Cl. Tail.
Cu-Pb 3rd Cleaner
Cu-Pb 3rd Cl. Tail.
Condition
Copper Flotation
Heat
Pyrite Flotation
Cool And Condition
Zinc Flotation
Zn Flot. Tailing (Pb Conc.)
Cu 1st Cleaner
Cu 1st Cl. Tail.
Py. 1st Cleaner
Py. 1st Cl. Tail.
Zinc Cleaner
Zn Cl. Tail.
Cu 2nd Cleaner
Cu 2nd Cl. Tail.
Py. 2nd Cleaner
Py. 2nd Cl. Tail.
Zn Cleaner Concentrate
Cu Cleaner Concentrate
Pyrite Cl. Concentrate

Test No. 115 - Continued

Metallurgical Results

ProductProduct	Weight	Assays, %			% Distribution		
	%	Cu	Pb	Zn	Cu	Pb	Zn
1. Cu Cleaner Concentrate	1.09	19.0	5.77	4.26	61.1	2.0	0.6
2. Cu 2nd Cleaner Tail.	0.75	5.67	16.8	8.69	12.5	4.0	0.8
3. Cu 1st Cleaner Tail.	1.10	0.87	21.2	9.49	2.8	7.4	1.2
4. Zn Flot. Tail.(Pb Conc.)	1.99	0.48	40.7	19.3	2.8	25.6	4.6
5. Zn Cleaner Tailing	0.31	0.64	41.0	20.2	0.6	4.0	0.7
6. Zn Cleaner Concentrate	0.68	0.46	19.2	42.5	0.9	4.1	3.5
7. Py. 1st Cleaner Tail.	3.48	0.20	14.8	4.67	2.1	16.3	1.9
8. Py. 2nd Cleaner Tail.	1.09	0.17	7.97	2.98	0.6	2.7	0.4
9. Py. Cleaner Concentrate	3.73	0.092	4.26	1.70	1.0	5.0	0.8
10. Cu-Pb 3rd Cl. Tailing	3.46	0.18	3.03	9.69	1.8	3.3	4.0
11. Cu-Pb 2nd Cl. Tailing	4.58	0.12	2.15	9.82	1.6	3.1	5.4
12. Cu-Pb 1st Cl. Tailing	11.90	0.096	1.64	10.9	3.4	6.2	15.5
13. Cu-Pb Rougher Tailing	65.84	0.045	0.79	7.72	8.8	16.3	60.6
Head (Calculated)	100.00	0.34	3.17	8.38	100.0	100.0	100.0

Calculated Grades and Recoveries

Products 1 and 2	1.84	13.57	10.27	6.07	73.6	6.0	1.4
Products 1 to 3	2.94	8.82	14.36	7.35	76.4	13.4	2.6
Products 4 and 5	2.30	0.50	40.74	19.4	3.4	29.6	5.3
Products 4 to 6	2.98	0.49	35.83	24.7	4.3	33.7	8.8
Products 4 to 7	6.46	0.34	24.50	13.9	6.4	50.0	10.7
Products 4 to 8	7.55	0.31	22.11	12.3	7.0	52.7	11.1
Products 4 to 9	11.28	0.24	16.21	8.81	8.0	57.7	11.9
Products 1 to 9	14.22	2.01	15.83	8.51	84.4	71.1	14.5
Products 1 to 10	17.68	1.65	13.32	8.74	86.2	74.4	18.5
Products 1 to 11	22.26	1.34	11.02	8.96	87.8	77.5	23.9
Products 1 to 12	34.16	0.91	7.76	9.64	91.2	83.7	39.4

Test No. 116

Purpose: To investigate the effect of floating and cleaning the bulk Cu-Pb concentrate at a higher pH (10.5 with $Ca(OH)_2$.)

Procedure: As for test No. 115, except Zn concentrate cleaned twice.

Feed: 2000 grams minus 10 mesh Composite No. 4.

Grind: 40 minutes at 66 % solids in the laboratory ball mill.

Conditions:

Stage	Reagents Added, grams per tonne						Time, minutes			pH
	Na_2CO_3	LS-3	$Ca(OH)_2$	343/350	241	MIBC	Grind	Cond.	Froth	
Primary Grind	3000	150	-	-	-	-	40	-	-	-
Aeration	1500	-	-	-	-	-	-	30	-	9.2
Condition	500	-	1000	-	-	-	-	2	-	10.5
Cu-Pb Rougher	-	-	-	10	10	10	-	1	2	-
	200	-	-	10	10	-	-	1	2	-
	250	-	-	10	10	-	-	1	2	-
	250	-	-	10	10	-	-	1	2	9.7
Conc. Regrind	500	30	-	-	-	-	15	-	-	-
Cu-Pb 1st Cl.	450	-	400	2.5	-	2.5	-	1	3	10.5
	-	-	-	2.5	-	2.5	-	1	3	-
Cu-Pb 2nd Cl.	250	15	150	-	-	-	-	1	2	10.5
	-	-	-	2.0	-	2	-	1	3	-
Cu-Pb 3rd Cl.	250	15	100	-	-	2	-	1	4	10.5

Test No. 116 - Continued

Conditions:

Stage	Reagents Added, grams per tonne							Time, minutes			pH
	Na_2-CO_3	A.C.	SO_2	Guar H-31	M2030	MIBC	A343	Grind	Cond.	Froth	
Cu-Pb Separation											
Conditioning	200	-	-	200	-	-	-	-	5	-	9.5
	-	450	900	-	-	-	-	-	5	-	4.5
	-	-	-	-	10	-	-	-	5	-	4.5
Cu Rougher	-	-	-	-	-	-	-	-	1	3	-
	-	-	-	-	10	2	-	-	1	2	-
Cu 1st Cl.	-	-	100	20	-	-	-	-	3	2	4.5
	-	-	-	-	-	2	-	-	1	2	-
Cu 2nd Cl.	-	-	80	10	-	-	-	-	3	2	4.5
	-	-	-	-	-	2	-	-	1	1	-
Pb Upgrading											
Heat to 85°C	-	-	-	-	-	-	-	-	10	-	-
Pyrite Rougher	-	-	-	-	-	5	10	-	1	3	-
	-	-	-	-	-	5	5	-	1	2	-
Pyrite 1st Cl.	-	-	-	-	-	2	-	-	1	2	-
	-	-	-	-	-	2	-	-	1	2	-
Pyrite 2nd Cl.	-	-	-	-	-	-	-	-	2	2	-
	-	-	-	-	-	2	-	-	1	1	-

Conditions:

Stage	Reagents Added, grams per tonne			Time, minutes			pH
	CaO	$CuSO_4$	A343	Grind	Cond.	Froth	
Pb Conc. Dezincing							
Cool to 30°C	200	-	-	-	10	-	10.5
Condition	-	100	-	-	10	-	-
Zn Rougher	-	-	5	-	1	3	-
	-	-	2	-	1	3	-
Zn 1st Cleaner	100	-	-	-	2	3	11.0
Zn 2nd Cleaner	100	-	-	-	2	2	11.3

Test No. 116 - Continued

Metallurgical Results

Product	Weight	Assays, %			% Distribution		
	%	Cu	Pb	Zn	Cu	Pb	Zn
1. Cu Cleaner Concentrate	1.38	17.1	10.4	4.03	68.9	4.5	0.7
2. Cu 2nd Cleaner Tailing	0.30	3.06	19.7	10.9	2.7	1.8	0.4
3. Cu 1st Cleaner Tailing	0.58	1.48	18.1	15.8	2.5	3.3	1.1
4. Zn Flot. Tail.(Pb Conc.)	1.75	0.35	49.1	8.17	1.8	26.7	1.7
5. Zn 1st Cleaner Tailing	0.35	0.68	35.8	2.48	0.7	3.9	0.1
6. Zn 2nd Cleaner Tailing	0.20	0.53	47.5	2.59	0.3	3.0	0.1
7. Zn Cleaner Concentrate	1.75	0.40	21.2	40.6	2.0	11.5	8.4
8. Pyrite 1st Cleaner Tail.	1.38	0.37	11.0	5.31	1.5	4.7	0.9
9. Pyrite 2nd Cleaner Tail.	0.12	0.62	10.1	3.79	0.2	0.4	0.1
10. Pyrite Cleaner Conc.	4.18	0.19	5.82	2.01	2.3	7.6	1.0
11. Cu-Pb 3rd Cl. Tailing	2.90	0.27	4.30	11.4	2.3	3.9	3.9
12. Cu-Pb 2nd Cl. Tailing	4.76	0.16	2.80	10.6	2.2	4.1	6.0
13. Cu-Pb 1st Cl. Tailing	12.95	0.088	1.71	10.3	3.3	6.9	15.8
14. Cu-Pb Rougher Tailing	67.40	0.047	0.85	7.48	9.3	17.7	59.8
Head (Calculated)	100.00	0.34	3.22	8.42	100.0	100.0	100.0

Calculated Grades and Recoveries

Products 1 and 2	1.68	14.60	12.06	5.26	71.6	6.3	1.1
Products 1 to 3	2.26	11.23	13.61	7.96	74.1	9.6	2.2
Products 4 and 5	2.10	0.40	46.89	7.22	2.5	30.6	1.8
Products 4 to 6	2.30	0.42	46.94	6.82	2.8	33.6	1.9
Products 4 to 7	4.05	0.41	35.82	21.4	4.8	45.1	10.3
Products 4 to 8	5.43	0.40	29.51	17.32	6.3	49.8	11.2
Products 4 to 9	5.55	0.40	29.09	17.03	6.5	50.2	11.3
Products 4 to 10	9.73	0.31	19.09	10.58	8.8	57.8	12.3
Products 1 to 10	11.99	2.37	18.06	10.08	82.9	67.4	14.5
Products 1 to 11	14.89	1.96	15.38	10.34	85.2	71.3	18.4
Products 1 to 12	19.65	1.52	12.33	10.40	87.4	75.4	24.4
Products 1 to 13	32.60	0.95	8.11	10.36	90.7	82.3	40.2

Test No. 117

Purpose: To repeat the bulk flotation procedure of test No. 116, but replace depressant LS-3 with LS-3A.

Procedure: Grind, aerate and float a Cu-Pb bulk concentrate. Regrind the concentrate and clean three times.

Feed: 2000 grams minus 10 mesh Composite No. 4.

Grind: 40 minutes at 66 % solids in the laboratory ball mill.

Conditions:

Stage	Reagents Added, grams per tonne						Time, minutes			pH
	Na_2CO_3	LS-3A	$Ca(OH)_2$	343/350	241	MIBC	Grind	Cond.	Froth	
Primary Grind	3000	150	-	-	-	-	40	-	-	-
Aeration	1500	-	-	-	-	-	-	30	-	9.2
Condition	500	-	1000	-	-	-	-	2	-	10.5
Cu-Pb Rougher	-	-	-	10	10	10	-	1	2	-
	200	-	-	10	10	-	-	1	2	-
	250	-	-	10	10	-	-	1	2	-
	250	-	-	10	10	-	-	1	2	-
Conc. Regr.	500	30	-	-	-	-	15	-	-	-
Cu-Pb 1st Cl.	450	-	400	2.5	-	2.5	-	1	3	10.5
	-	-	-	2.5	-	2.5	-	1	3	-
Cu-Pb 2nd Cl.	250	15	150	-	-	-	-	1	2	10.5
	-	-	-	2	-	-	-	1	3	-
Cu-Pb 3rd Cl.	250	15	100	-	-	2	-	1	4	10.5

Test No. 117 - Continued

Metallurgical Results

Product	Weight %	Assays, %			% Distribution		
		Cu	Pb	Zn	Cu	Pb	Zn
1. Cu-Pb Cleaner Conc.	11.32	2.50	19.4	9.20	82.8	66.9	12.6
2. Cu-Pb 3rd Cl. Tail.	3.28	0.26	5.41	11.4	2.5	5.4	4.5
3. Cu-Pb 2nd Cl. Tail.	6.32	0.17	2.93	10.8	3.1	5.6	8.2
4. Cu-Pb 1st Cl. Tail.	11.26	0.075	1.56	10.3	2.5	5.4	14.0
5. Cu-Pb Rougher Tail.	67.82	0.046	0.81	7.43	9.1	16.7	60.7
Head (Calculated)	100.00	0.34	3.28	8.30	100.0	100.0	100.0

Calculated Grades and Recoveries

Products 1 and 2	14.60	2.00	16.26	9.69	85.3	72.3	17.1
Products 1 to 3	20.92	1.44	12.23	10.03	88.4	77.9	25.3
Products 1 to 4	32.18	0.97	8.50	10.12	90.9	83.3	39.3

Test No. 118

Purpose: To repeat test No. 117, but replace depressant LS-3A with LS-3B.

Procedure: As for test No. 117.

Feed: 2000 grams minus 10 mesh Composite No. 4.

Grind: 40 minutes at 66 % solids in the laboratory ball mill.

Conditions:

Stage	Reagents Added, g/tonne						Time, minutes			pH
	Na_2CO_3	LS-3B	$Ca(OH)_2$	343/350	241	MIBC	Grind	Cond.	Froth	
Primary Grind	3000	150	-	-	-	-	40	-	-	-
Aeration	1500	-	-	-	-	-	-	30	-	9.1
Condition	-	-	1000	-	-	-	-	2	-	10.5
Cu-Pb Rougher	-	-	-	10	10	10	-	1	2	-
	200	-	-	10	10	-	-	1	2	-
	250	-	-	10	10	-	-	1	2	-
	250	-	-	10	10	-	-	1	2	-
Conc. Regrind	500	30	-	-	-	-	15	-	-	-
Cu-Pb 1st Cl.	450	-	400	2.5	-	2.5	-	1	3	10.5
	-	-	-	2.5	-	2.5	-	1	3	-
Cu-Pb 2nd Cl.	250	15	150	-	-	-	-	1	2	10.5
	-	-	-	2.0	-	-	-	1	3	-
Cu-Pb 3rd Cl.	250	15	100	-	-	2	-	1	4	10.5

Test No. 118 - Continued

Metallurgical Results

Product	Weight	Assays, %			% Distribution		
	%	Cu	Pb	Zn	Cu	Pb	Zn
1. Cu-Pb Cleaner Conc.	13.41	2.10	16.9	9.67	81.2	69.8	15.1
2. Cu-Pb 3rd Cl. Tail.	3.13	0.25	3.68	11.0	2.2	3.5	4.0
3. Cu-Pb 2nd Cl. Tail.	4.60	0.15	2.42	10.2	2.0	3.4	5.5
4. Cu-Pb 1st Cl. Tail.	14.06	0.11	1.68	10.4	4.5	7.3	17.0
5. Cu-Pb Rougher Tail.	64.80	0.054	0.80	7.73	10.1	16.0	58.4
Head (Calculated)	100.00	0.35	3.25	8.58	100.0	100.0	100.0

Calculated Grades and Recoveries

Products 1 and 2	16.54	1.75	14.4	9.92	83.4	73.3	19.1
Products 1 to 3	21.14	1.40	11.8	9.98	85.4	76.7	24.6
Products 1 to 4	35.20	0.89	7.75	10.15	89.9	84.0	41.6

Test No. 119

Purpose: To repeat test No. 117, but replace depressant LS-3A with LS-3C.

Procedure: As for test No. 117.

Feed: 2000 grams minus 10 mesh Composite No. 4.

Grind: 40 minutes at 66 % solids in the laboratory ball mill.

Conditions:

Stage	Reagents Added, grams per tonne						Time, minutes			pH
	Na_2CO_3	LS-3C	$Ca(OH)_2$	343/350	241	MIBC	Grind	Cond.	Froth	
Primary Grind	3000	150	-	-	-	-	40	-	-	-
Aeration	1500	-	-	-	-	-	-	30	-	9.1
Condition	-	-	1000	-	-	-	-	2	-	10.5
Cu-Pb Rougher	-	-	-	10	10	10	-	1	2	-
	200	-	-	10	10	-	-	1	2	-
	250	-	-	10	10	-	-	1	2	-
	250	-	-	10	10	-	-	1	2	-
Conc. Regrind	500	30	-	-	-	-	15	-	-	-
Cu-Pb 1st Cl.	450	-	400	2.5	2.5	-	-	1	3	10.5
	-	-	-	2.5	2.5	-	-	1	3	-
Cu-Pb 2nd Cl.	250	15	150	-	-	-	-	1	2	10.5
	-	-	-	2.0	-	-	-	1	3	-
Cu-Pb 3rd Cl.	250	15	100	-	2	-	-	1	4	10.5

Test No. 119 - Conzinued

Metallurgical Results

Product	Weight	Assays, %			% Distribution		
	%	Cu	Pb	Zn	Cu	Pb	Zn
1. Cu-Pb Cleaner Conc.	12.48	2.33	18.2	9.74	81.7	68.2	14.3
2. Cu-Pb 3rd Cl. Tail.	3.11	0.28	4.78	10.7	2.4	4.5	3.9
3. Cu-Pb 2nd Cl. Tail.	5.12	0.18	2.84	10.7	2.6	4.4	6.5
4. Cu-Pb 1st Cl. Tail.	13.45	0.11	1.67	10.1	4.2	6.7	16.0
5. Cu-Pb Rougher Tail.	65.84	0.049	0.82	7.64	9.1	16.2	59.3
Head (Calculated)	100.00	0.36	3.33	8.48	100.0	100.0	100.0

Calculated Grades and Recoveries

Products 1 and 2	15.59	1.92	15.52	9.93	84.1	72.7	18.2
Products 1 to 3	20.71	1.49	12.39	10.12	86.7	77.1	24.7
Products 1 to 4	34.16	0.95	8.17	10.11	90.9	83.8	40.7

Test No. 120

Purpose: To repeat test No. 115, but clean copper concentrate three times and add an extra stage to pyrite rougher flotation.

Procedure: As for test No. 115, but three copper cleaners.

Feed: 2000 grams minus 10 mesh Composite No. 4.

Grind: 40 minutes at 66 % solids in the lab ball mill.

Conditions:

Stage	Reagents Added, grams per tonne						Time, minutes			pH
	Na_2-CO_3	LS-3	Ca-$(OH)_2$	343/350	241	MIBC	Grind	Cond.	Froth	
Primary Grind	3000	150	-	-	-	-	40	-	-	-
Aeration	1500	-	-	-	-	-	-	30	-	-
Condition	-	-	1000	-	-	-	-	2	-	10.5
Cu-Pb Rougher	-	-	-	10	10	10	-	1	2	-
	200	-	-	10	10	-	-	1	2	-
	250	-	-	10	10	-	-	1	2	-
	250	-	-	10	10	-	-	1	2	-
Conc. Regrind	500	30	-	-	-	-	15	-	-	-
Cu-Pb 1st Cl.	450	-	400	2.5	2.5	-	-	1	3	10.5
	-	-	-	2.5	2.5	-	-	1	3	-
Cu-Pb 2nd Cl.	250	15	150	-	-	-	-	1	2	10.5
	-	-	-	2.0	-	-	-	1	3	-
Cu-Pb 3rd Cl.	250	15	100	-	2	-	-	1	4	10.5

Test No. 120 - Continued

Conditions:

Stage	Reagents Added, grams per tonne							Time, minutes			pH
	Na_2-CO_3	A.C.	SO_2	Guar H-31	M2030	MIBC	A343	Grind	Cond.	Froth	
Cu-Pb Separation											
Condition	200	-	-	200	-	-	-	-	5	-	10.0
	-	450	1100	-	-	-	-	-	5	-	4.5
Cu Rougher	-	-	-	-	10	5	-	-	5	3	-
	-	-	-	-	5	-	-	-	1	2	-
Cu 1st Cl.	-	-	100	20	-	-	-	-	3	2	4.5
	-	-	-	-	2	2	-	-	1	2	-
Cu 2nd Cl.	-	-	75	10	-	-	-	-	3	2	4.5
	-	-	-	-	-	2	-	-	1	1	-
Cu 3rd Cl.	-	-	50	10	-	-	-	-	2	2	4.5
Pb Upgrading											
Heat to 85°C	-	-	-	-	-	-	-	-	10	-	-
Pyrite Rougher	-	-	-	-	-	5	10	-	1	3	5.5
	-	-	-	-	-	5	5	-	1	2	-
	-	-	-	-	-	5	5	-	1	2	-
Pyrite 1st Cl.	-	-	-	-	-	2	-	-	1	3	5.8
	-	-	-	-	-	2	-	-	1	2	-
Pyrite 2nd Cl.	-	-	-	-	-	2	-	-	1	3	6.0

Test No. 120 - Continued

Metallurgical Results

Product	Weight %	Assays, %			% Distribution		
		Cu	Pb	Zn	Cu	Pb	Zn
1. Cu Cleaner Conc.	0.54	23.3	9.69	3.07	40.6	1.6	0.2
2. Cu 3rd Cl. Tail.	0.27	7.40	25.5	7.52	6.5	2.2	0.2
3. Cu 2nd Cl. Tail.	0.41	3.80	25.9	9.02	5.0	3.3	0.4
4. Cu 1st Cl. Tail.	1.55	2.09	21.5	9.94	10.5	10.5	1.8
5. Pyrite Ro. Tail.	1.65	0.45	24.2	25.0	2.4	12.7	4.9
6. Py. 1st Cl. Tail.	1.25	0.48	13.6	8.61	1.9	5.4	1.3
7. Py. 2nd Cl. Tail.	0.99	0.61	14.4	6.32	1.9	4.5	0.7
8. Pyrite Cl. Conc.	5.44	0.71	16.4	7.23	12.5	28.1	4.7
9. Cu-Pb 3rd Cl. Tail.	3.47	0.29	4.21	11.6	3.3	4.6	4.8
10. Cu-Pb 2nd Cl. Tail.	5.05	0.14	2.58	10.4	2.3	4.1	6.2
11. Cu-Pb 1st Cl. Tail.	10.90	0.084	1.67	10.2	3.0	5.7	13.1
12. Cu-Pb Rougher Tail.	68.48	0.046	0.80	7.61	10.1	17.3	61.7
Head (Calculated)	100.00	0.31	3.17	8.45	100.0	100.0	100.0

Calculated Grades and Recoveries

Products 1 and 2	0.81	18.0	14.95	4.56	47.1	3.8	0.4
Products 1 to 3	1.22	13.23	18.63	6.06	52.1	7.1	0.8
Products 1 to 4	2.77	7.00	20.24	8.23	62.6	17.6	2.6
Products 5 and 6	2.90	0.46	19.63	17.93	4.3	18.1	6.2
Products 5 to 7	3.89	0.50	18.3	15.0	6.2	22.6	6.9
Products 5 to 8	9.33	0.62	17.2	10.5	18.7	50.7	11.6
Products 1 to 8	12.10	2.08	17.89	9.95	81.3	68.3	14.2
Products 1 to 11	31.52	0.88	8.32	10.3	89.9	82.7	38.3

Test No. 121

Purpose: To perform a standard bulk flotation test on the newly received sample of Composite No. 4(designated Composite No. 4A).

Procedure: As for test No. 117.

Feed: 2000 grams minus 10 mesh Composite No. 4A.

Grind: 40 minutes at 66 % solids in the laboratory ball mill.

Conditions:

Stage	Reagents Added, grams per tonne						Time, minutes			pH
	Na_2CO_3	LS-3	$Ca(OH)_2$	343/ 350*	241	MIBC	Grind	Cond.	Froth	
Primary Grind	3000	150	-	-	-	-	40	-	-	-
Aeration	-	-	-	-	-	-	-	30	-	9.2
Condition	500	-	900	-	-	-	-	2	-	10.2
Cu-Pb Rougher	-	-	-	10	10	10	-	1	2	-
	200	-	-	10	10	-	-	1	2	-
	250	-	-	10	10	-	-	1	2	-
	250	-	-	10	10	-	-	1	2	-
Conc. Regrind	500	30	-	-	-	-	15	-	-	-
Cu-Pb 1st Cl.	450	-	300	2.5	-	2.5	-	1	3	10.5
	-	-	-	2.5	-	2.5	-	1	3	-
Cu-Pb 2nd Cl.	250	15	150	-	-	-	-	1	2	10.5
	-	-	-	2	-	-	-	1	3	-
Cu-Pb 3rd Cl.	250	15	100	-	-	2	-	1	4	10.5

* 4 to 1 of 343 to 350

Test No. 121 - Continued

Metallurgical Results

Product	Weight	Assays, %			% Distribution		
	%	Cu	Pb	Zn	Cu	Pb	Zn
1. Cu-Pb Cleaner Conc.	13.09	1.22	21.0	11.0	80.1	74.3	15.3
2. Cu-Pb 3rd Cl. Tail.	3.47	0.15	3.89	12.8	2.6	3.6	4.7
3. Cu-Pb 2nd Cl. Tail.	5.70	0.10	2.42	12.1	2.9	3.7	7.3
4. Cu-Pb 1st Cl. Tail.	14.85	0.063	1.35	11.6	4.7	5.5	18.3
5. Cu-Pb Rougher Tail.	62.89	0.031	0.76	8.15	9.7	12.9	54.4
Head (Calculated)	100.00	0.20	3.70	9.42	100.0	100.0	100.0

Calculated Grades and Recoveries

Products 1 and 2	16.56	1.00	17.4	11.4	82.7	77.9	20.0
Products 1 to 3	22.26	0.77	13.6	11.6	85.6	81.6	27.3
Products 1 to 4	37.11	0.49	8.68	11.6	90.3	87.1	45.6

Test No. 122

Purpose:	To investigate the effect of floating a double charge of Composite No. 4 (Roughing in D-2 and cleaning in D-1).
Procedure:	Grind two 2000 grams charges simultaneously and combine in D-2 cell. Aerate and float a Cu-Pb rougher concentrate. Regrind the concentrate and clean three times.
Feed:	Two 2000 gram charges minus 10 mesh Composite No. 4.
Grind:	40 minutes per charge at 66 % solids in the laboratory ball mill.

Conditions:

Stage	Reagents Added, grams per tonne						Time, minutes			pH
	Na_2CO_3	LS-3	$Ca(OH)_2$	343/ 350	241	MIBC	Grind	Cond.	Froth	
Primary Grind	3000	150	-	-	-	-	80	-	-	-
Combine the two ground charges										
Aeration	500	-	-	-	-	-	-	30	-	9.2
Condition	500	-	1000	-	-	-	-	2	-	10.5
Cu-Pb Rougher	-	-	-	10	10	7.5	-	1	2	-
	200	-	-	10	10	-	-	1	2	-
	250	-	-	10	10	-	-	1	2	-
	250	-	-	10	10	-	-	1	2	-
Conc. Regrind	500	30	-	-	-	-	30	-	-	-
Cu-Pb 1st Cl.	450	-	400	2.5	-	2.5	-	1	3	10.5
	-	-	-	2.5	-	-	-	1	3	-
Cu-Pb 2nd Cl.	250	15	100	-	-	-	-	1	2	10.5
	-	-	-	2	-	2	-	1	3	-
Cu-Pb 3rd Cl.	250	15	75	-	-	2	-	1	4	10.5

Stage	Aeration	Rougher	Conc. Regrind	Cleaners
Flotation Cell	2000 g D - 2	2000 g D - 2	Rod Mill	1000 g D - 1
Speed: r.p.m.	1500	1300	-	1800
% Solids	35	33	-	-

Test No. 122 - Continued

Metallurgical Results

Product	Weight %	Assays, %			% Distribution		
		Cu	Pb	Zn	Cu	Pb	Zn
1. Cu-Pb Cleaner Conc.	7.59	3.49	23.7	7.67	76.5	54.1	6.8
2. Cu-Pb 3rd Cl. Tail.	2.14	0.39	12.2	9.71	2.4	7.8	2.4
3. Cu-Pb 2nd Cl. Tail.	6.49	0.30	5.91	11.0	5.6	11.5	8.3
4. Cu-Pb 1st Cl. Tail.	12.67	0.13	2.21	11.6	4.8	8.4	17.1
5. Cu-Pb Rougher Tail.	71.11	0.052	0.85	7.92	10.7	18.2	65.4
Head (Calculated)	100.00	0.35	3.32	8.61	100.0	100.0	100.0

Calculated Grades and Recoveries

Products 1 and 2	9.73	2.81	21.2	8.12	78.8	61.9	9.2
Products 1 to 3	16.22	1.80	15.1	9.27	84.5	73.4	17.5
Products 1 to 4	28.89	1.07	9.43	10.3	89.3	81.8	34.6

Test No. 123

Purpose: To repeat test No. 122, but omit depressant LS-3.

Procedure: As for test No. 122.

Feed: Two 2000 grams charges minus 10 mesh Composite No. 4.

Grind: 40 minutes per charge at 66 % solids in the laboratory ball mill.

Conditions:

Stage	Reagents Added, grams per tonne					Time, minutes			pH
	Na_2CO_3	$Ca(OH)_2$	343/350	241	MIBC	Grind	Cond.	Froth	
Primary Grind	3000	-	-	-	-	80	-	-	-
Combine the two ground charges									
Aeration	500	-	-	-	-	-	30	-	9.2
Condition	500	1000	-	-	-	-	2	-	10.5
Cu-Pb Rougher	-	-	10	10	7.5	-	1	2	-
	200	-	10	10	-	-	1	2	-
	250	-	10	10	-	-	1	2	-
	250	-	10	10	-	-	1	2	-
Conc. Regrind	500	-	-	-	-	30	-	-	-
Cu-Pb 1st Cl.	450	400	2.5	-	2.5	-	1	3	10.5
	-	-	2.5	-	-	-	1	3	-
Cu-Pb 2nd Cl.	250	100	-	-	-	-	1	2	10.5
	-	-	2	-	2	-	1	3	-
Cu-Pb 3rd Cl.	250	75	-	-	2	-	1	4	10.5

Test No. 123 - Continued

Metallurgical Results

Product	Weight %	Assays, %			% Distribution		
		Cu	Pb	Zn	Cu	Pb	Zn
1. Cu-Pb Cleaner Conc.	7.28	3.70	26.4	7.57	80.3	58.1	6.4
2. Cu-Pb 3rd Cl. Tail.	1.72	0.37	11.3	10.3	1.9	5.9	2.1
3. Cu-Pb 2nd Cl. Tail.	4.60	0.24	4.72	10.8	3.3	6.6	5.8
4. Cu-Pb 1st Cl. Tail.	14.91	0.10	2.42	10.9	4.5	10.9	18.9
5. Cu-Pb Rougher Tail.	71.49	0.047	0.86	8.01	10.0	18.5	66.8
Head (Calculated)	100.00	0.34	3.31	8.58	100.0	100.0	100.0

Calculated Grades and Recoveries

Products 1 and 2	9.00	3.06	23.5	8.09	82.2	64.0	8.5
Products 1 to 3	13.60	2.11	17.2	9.01	85.5	70.6	14.3
Products 1 to 4	28.51	1.06	9.45	10.0	90.0	81.5	33.2

Test No. 124

Purpose:	To repeat test No. 122, but increase flotation time in rougher and decrease regrind time.
Procedure:	As for test No. 122.
Feed:	two 2000 grams charges minus 10 mesh Composite No. 4.
Grind:	40 minutes per charge at 66 % solids in the lab ball mill.
Conditions:	

Stage	Reagents Added, grams per tonne						Time, minutes			pH
	Na_2CO_3	LS-3	$Ca(OH)_2$	343/ 350	241	MIBC	Grind	Cond.	Froth	
Primary Grind	4000	150	-	-	-	-	80	-	-	-
Combine the two ground charges										
Aeration	250	-	-	-	-	-	-	30	-	9.2
Condition	500	-	1000	-	-	-	-	2	-	10.5
Cu-Pb Rougher	-	-	-	10	10	10	-	1	3	-
	200	-	-	10	10	-	-	1	3	-
	250	-	-	10	10	-	-	1	3	-
	250	-	-	10	10	-	-	1	3	-
Conc. Regrind	500	30	-	-	-	-	20	-	-	-
Cu-Pb 1st Cl.	400	-	350	2.5	-	2.5	-	1	3	10.5
	-	-	-	2.5	-	-	-	1	4	-
Cu-Pb 2nd Cl.	250	15	100	-	-	-	-	1	2	10.5
	-	-	-	2	-	2	-	1	3	-
Cu-Pb 3rd Cl.	250	15	75	-	-	2	-	1	4	10.5

Test No. 124 - Continued

Metallurgical Results

Product	Weight %	Assays, %			% Distribution		
		Cu	Pb	Zn	Cu	Pb	Zn
1. Cu-Pb Cleaner Conc.	9.50	2.83	22.4	8.03	79.7	65.0	8.9
2. Cu-Pb 3rd Cl. Tail.	2.19	0.40	7.39	12.3	2.6	4.9	3.1
3. Cu-Pb 2nd Cl. Tail.	5.12	0.24	3.84	11.7	3.6	6.0	7.0
4. Cu-Pb 1st Cl. Tail.	14.52	0.11	1.79	11.3	4.7	7.9	19.2
5. Cu-Pb Rougher Tail.	68.67	0.046	0.77	7.69	9.4	16.2	61.8
Head (Calculated)	100.00	0.34	3.28	8.55	100.0	100.0	100.0

Calculated Grades and Recoveries

Products 1 and 2	11.69	2.38	19.6	8.83	82.3	69.9	12.0
Products 1 to 3	16.81	1.73	14.8	9.70	85.9	75.9	19.0
Products 1 to 4	31.33	0.98	8.77	10.44	90.6	83.8	38.2

Test No. 125

Purpose: To repeat test No. 123, but on Composite No. 4A.

Procedure: As for test No. 122.

Feed: Two 2000 grams charges minus 10 mesh Composite No. 4A.

Grind: 40 minutes per charge at 66 % solids in the laboratory ball mill.

Conditions:

Stage	Reagents Added, g/tonne					Time, minutes			pH
	Na_2CO_3	$Ca(OH)_2$	343/ 350	241	MIBC	Grind	Cond.	Froth	
Primary Grind	3000	-	-	-	-	80	-	-	-
Combine the two ground charges.									
Aeration	250	-	-	-	-	-	30	-	9.2
Condition	500	600	-	-	-	-	2	-	10.5
Cu-Pb Rougher	-	-	10	10	7.5	-	1	2	-
	200	-	10	10	-	-	1	2	-
	250	-	10	10	-	-	1	2	-
	250	-	10	10	-	-	1	2	-
Conc. Regrind	500	-	-	-	-	30	-	-	-
Cu-Pb 1st Cl.	450	200	2.5	-	2.5	-	1	3	10.5
	-	-	2.5	-	-	-	1	3	-
Cu-Pb 2nd Cl.	250	100	-	-	-	-	1	2	10.5
	-	-	2	-	2	-	1	3	-
Cu-Pb 3rd Cl.	250	75	-	-	2	-	1	4	10.5

Test No. 125 - Continued

Metallurgical Results

Product	Weight %	Assays, %			% Distribution		
		Cu	Pb	Zn	Cu	Pb	Zn
1. Cu-Pb Cleaner Conc.	10.53	1.53	26.4	9.93	77.7	73.6	11.1
2. Cu-Pb 3rd Cl. Tail.	1.60	0.20	4.67	12.6	1.5	2.0	2.1
3. Cu-Pb 2nd Cl. Tail.	4.65	0.14	2.61	12.2	3.1	3.2	6.0
4. Cu-Pb 1st Cl. Tail.	14.94	0.062	1.29	12.3	4.5	5.1	19.5
5. Cu-Pb Rougher Tail.	68.28	0.040	0.89	8.44	13.2	16.1	61.3
Head (Calculated)	100.00	0.21	3.78	9.41	100.0	100.0	100.0

Calculated Grades and Recoveries

Products 1 and 2	12.13	1.35	23.5	10.3	79.2	75.6	13.2
Products 1 to 3	16.78	1.02	17.7	10.8	82.3	78.8	19.2
Products 1 to 4	31.72	0.57	9.99	11.5	86.8	83.9	38.7

Test No. 126

Purpose: To repeat test No. 124, but on Composite No. 4A.

Procedure: As for test No. 122.

Feed: two 2000 grams charges minus 10 mesh Composite No. 4A.

Grind: 40 minutes per charge at 66 % solids in the lab ball mill.

Conditions:

Stage	Reagents Added, grams per tonne						Time, minutes			pH
	Na_2CO_3	LS-3	$Ca(OH)_2$	343/350	241	MIBC	Grind	Cond.	Froth	
Primary Grind	3000	150	-	-	-	-	80	-	-	-
Combine the two ground charges										
Aeration	250	-	-	-	-	-	-	30	-	9.2
Condition	500	-	600	-	-	-	-	2	-	10.5
Cu-Pb Rougher	-	-	-	10	10	10	-	1	3	-
	-	-	-	10	10	-	-	1	3	-
	-	-	-	10	10	-	-	1	3	-
	-	-	-	10	10	-	-	1	3	-
Conc. Regrind	500	30	-	-	-	-	20	-	-	-
Cu-Pb 1st Cl.	450	-	200	2.5	2.5	-	-	1	3	10.5
	-	-	-	2.5	2	-	-	1	4	-
Cu-Pb 2nd Cl.	250	15	100	-	-	-	-	1	2	10.5
	-	-	-	2	-	-	-	1	3	-
Cu-Pb 3rd Cl.	250	15	75	-	2	-	-	1	4	10.5

Test No. 126 - Continued

Metallurgical Results

Product	Weight %	Assays, %			% Distribution		
		Cu	Pb	Zn	Cu	Pb	Zn
1. Cu-Pb Cleaner Conc.	10.70	1.44	25.0	9.47	76.5	71.3	10.9
2. Cu-Pb 3rd Cl. Tail.	2.49	0.19	5.83	13.2	2.3	3.9	3.5
3. Cu-Pb 2nd Cl. Tail.	5.38	0.16	3.35	12.5	4.3	4.8	7.3
4. Cu-Pb 1st Cl. Tail.	13.27	0.077	1.47	12.4	5.1	5.2	17.8
5. Cu-Pb Rougher Tail.	68.16	0.035	0.82	8.22	11.8	14.8	60.5
Head (Calculated)	100.00	0.20	3.75	9.26	100.0	100.0	100.0

Calculated Grades and Recoveries

Products 1 and 2	13.19	1.20	21.4	10.2	78.8	75.2	14.4
Products 1 to 3	18.57	0.90	16.2	10.8	83.1	80.0	21.7
Products 1 to 4	31.84	0.56	10.0	11.5	88.2	85.2	39.5

Test No. 127

Purpose: To produce a cleaner bulk concentrate for further separation from Composite No. 4A.

Procedure: See attached flowsheet.

Feed: Two 2000 gram charges minus 10 mesh Composite No. 4A.

Grind: 40 minutes per charge at 66 % solids in the lab ball mill.

Conditions:

Stage	Reagents Added, g/tonne				Time, minutes			pH
	Na_2CO_3	343/ 350	241	MIBC	Grind	Cond.	Froth	
Primary Grind	3000	-	-	-	80	-	-	-
Combine the two ground charges								
Aeration	200	-	-	-	-	30	-	9.2
Cu-Pb Rougher	250	10	10	7.5	-	1	2	9.2
	200	10	10	-	-	1	2	-
	250	10	10	-	-	1	2	-
	250	10	10	-	-	1	2	-
Conc. Regrind	500	-	-	-	30	-	-	-
Cu-Pb 1st Cl.	250	2.5	-	2.5	-	1	3	9.6
	-	2.5	-	2.5	-	1	3	-
Cu-Pb 2nd Cl.	250	-	-	-	-	1	2	9.6
	-	2	-	2	-	1	3	-
Cu-Pb 3rd Cl.	250	-	-	2	-	1	4	9.6

Test No. 127 - Continued

Conditions:

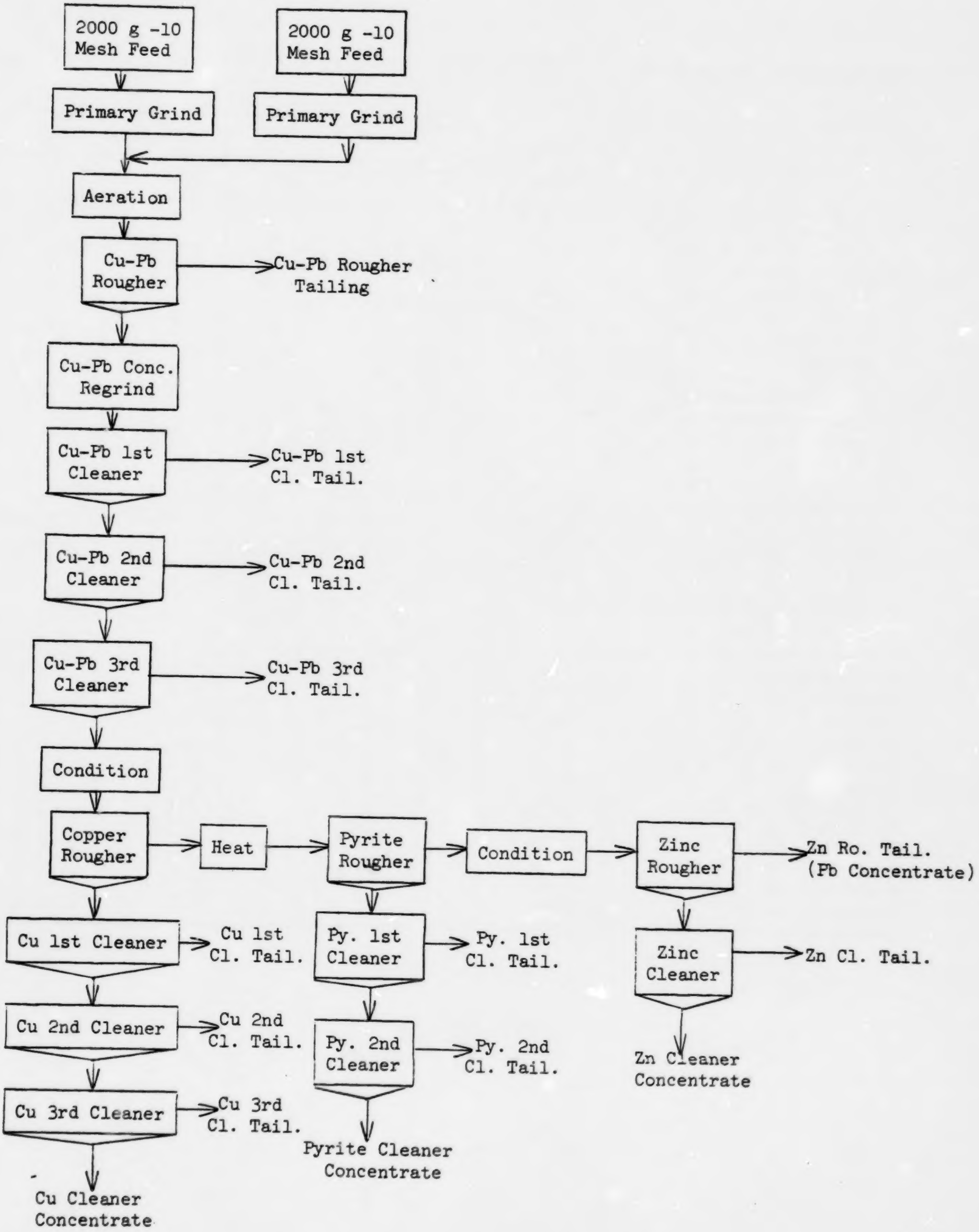
Stage	Reagents Added, grams per tonne							Time, minutes			pH
	Na_2CO_3	A.C.	SO_2	H-31	M2030	MIBC	A343	Grind	Cond.	Froth	
Cu-Pb Separation											
Condition	200	-	-	200	-	-	-	-	5	-	9.5
	-	450	800	175	-	-	-	-	5	-	4.5
Cu Rougher	-	-	-	-	5	2	-	-	5	3	-
	-	-	-	-	2.5	1	-	-	1	2	-
Cu 1st Cleaner	-	-	60	50	-	-	-	-	3	2	4.5
	-	-	-	-	-	1	-	-	1	1	-
Cu 2nd Cleaner	-	-	40	25	-	-	-	-	3	2	4.5
Cu 3rd Cleaner	-	-	30	50	-	1	-	-	3	1	4.0
Pb Upgrading											
Heat to 85°C	-	-	-	-	-	-	-	-	10	-	-
Pyrite Rougher	-	-	-	-	-	5	10	-	1	1	-
	-	-	-	-	-	2	10	-	1	2	-
Pyrite 1st Cl.	-	-	-	-	-	2	-	-	1	2	-
Pyrite 2nd Cl.	-	-	-	-	-	2	-	-	1	2	-

Conditions:

Stage	Reagents Added, grams per tonne			Time, minutes			pH
	$Ca(OH)_2$	$CuSO_4$	A343	Grind	Cond.	Froth	
Pb Concentrate Dezincing							
Filter pyrite rougher tailing and repulp.							
Condition	200	-	-	-	10	-	-
Zn Rougher	-	50	-	-	10	-	10.5
	-	-	5	-	1	2	-
	100	50	-	-	1	-	11.0
Zn Cleaner	-	-	5	-	1	2	-
	250	-	-	-	2	2	12.1

Test No. 127 - Continued

Flowsheet


2000 g -10 Mesh Feed
2000 g -10 Mesh Feed
Primary Grind
Primary Grind
Aeration
Cu-Pb Rougher
Cu-Pb Rougher Tailing
Cu-Pb Conc. Regrind
Cu-Pb 1st Cleaner
Cu-Pb 1st Cl. Tail.
Cu-Pb 2nd Cleaner
Cu-Pb 2nd Cl. Tail.
Cu-Pb 3rd Cleaner
Cu-Pb 3rd Cl. Tail.
Condition
Copper Rougher
Heat
Pyrite Rougher
Condition
Zinc Rougher
Zn Ro. Tail. (Pb Concentrate)
Cu 1st Cleaner
Cu 1st Cl. Tail.
Py. 1st Cleaner
Py. 1st Cl. Tail.
Zinc Cleaner
Zn Cl. Tail.
Cu 2nd Cleaner
Cu 2nd Cl. Tail.
Py. 2nd Cleaner
Py. 2nd Cl. Tail.
Zn Cleaner Concentrate
Cu 3rd Cleaner
Cu 3rd Cl. Tail.
Pyrite Cleaner Concentrate
Cu Cleaner Concentrate

Test No. 127 - Continued

Metallurgical Results

Product	Weight %	Assays, %			% Distribution		
		Cu	Pb	Zn	Cu	Pb	Zn
1. Cu Cleaner Concentrate	0.75	10.8	36.1	3.82	40.8	7.3	0.3
2. Cu 3rd Cleaner Tail.	0.56	3.27	44.8	5.62	9.2	6.8	0.3
3. Cu 2nd Cleaner Tail.	0.67	1.85	42.5	6.72	6.2	7.7	0.5
4. Cu 1st Cleaner Tail.	0.92	0.89	31.4	9.00	4.1	7.8	0.9
5. Zn Ro. Tail.(Pb Conc.)	0.57	0.73	41.5	16.0	2.1	6.4	1.0
6. Zn Cleaner Tailing	0.47	0.67	44.4	14.6	1.6	5.7	0.7
7. Zn Cleaner Concentrate	1.70	0.31	35.9	29.2	2.7	16.6	5.3
8. Py. 1st Cleaner Tail.	1.33	0.57	19.5	6.23	3.8	7.0	0.9
9. Py. 2nd Cleaner Tail.	0.73	0.36	10.2	3.53	1.3	2.0	0.3
10. Pyrite Cleaner Conc.	3.09	0.30	6.26	1.98	4.7	5.2	0.6
11. Cu-Pb 3rd Cl. Tail.	2.15	0.18	3.17	11.8	2.0	1.9	2.7
12. Cu-Pb 2nd Cl. Tail.	5.69	0.13	2.39	11.7	3.7	3.7	7.1
13. Cu-Pb 1st Cl. Tail.	13.80	0.065	1.31	12.3	4.5	4.9	18.0
14. Cu-Pb Rougher Tail.	67.57	0.039	0.92	8.58	13.3	17.0	61.4
Head (Calculated)	100.00	0.20	3.68	9.43	100.0	100.0	100.0

Calculated Grades and Recoveries

Products 1 and 2	1.31	7.58	39.8	4.59	50.0	14.1	0.6
Products 1 to 3	1.98	5.64	40.7	5.31	56.2	21.8	1.1
Products 1 to 4	2.90	4.13	37.8	6.48	60.3	29.6	2.0
Products 5 and 6	1.04	0.70	42.8	15.4	3.7	12.1	1.7
Products 5 to 7	2.74	0.46	38.5	23.9	6.4	28.7	7.0
Products 5 to 8	4.07	0.50	32.3	18.2	10.2	35.7	7.9
Products 5 to 9	4.80	0.48	28.9	15.9	11.5	37.7	8.2
Products 5 to 10	7.89	0.41	20.1	10.5	16.2	42.9	8.8
Products 1 to 10	10.79	1.41	24.8	9.40	76.5	72.5	10.8
Products 1 to 11	12.94	1.20	21.2	9.80	78.5	74.4	13.5
Products 1 to 12	18.63	0.88	15.5	10.4	82.2	78.1	20.6
Products 1 to 13	32.43	0.53	9.45	11.2	86.7	83.0	38.6

Test No. 128

Purpose: To repeat the procedure of test No. 127, but add depressant LS-3 to the Cu-Pb rougher and cleaners.

Procedure: As for test No. 127.

Feed: Two 2000 gram charges minus 10 mesh Composite No. 4A.

Grind: 40 minutes per charge at 66 % solids in the laboratory ball mill.

Conditions:

Stage	Reagents Added, g/tonne					Time, minutes			pH
	Na_2CO_3	LS-3	343/350	241	MIBC	Grind	Cond.	Froth	
Primary Grind	3000	150	-	-	-	80	-	-	-
Combine the two ground charges									
Aeration	200	-	-	-	-	-	30	-	9.2
Cu-Pb Rougher	250	-	10	10	7.5	-	1	2	9.2
	200	-	10	10	-	-	1	2	-
	250	-	10	10	-	-	1	2	-
	250	-	10	10	-	-	1	2	-
Conc. Regrind	500	30	-	-	-	30	-	-	-
Cu-Pb 1st Cl.	250	-	2.5	-	2.5	-	1	3	9.6
	-	-	2.5	-	2.5	-	1	3	-
Cu-Pb 2nd Cl.	250	15	-	-	-	-	1	2	9.6
	-	-	2	-	2	-	1	3	-
Cu-Pb 3rd Cl.	250	15	-	-	2	-	1	4	9.6

Test No. 128 - Continued

Conditions:

Stage	Reagents Added, grams per tonne							Time, minutes			pH
	Na_2CO_3	H-31	A.C.	SO_2	M2030	MIBC	A-343	Grind	Cond.	Froth	
Cu-Pb Separation											
Filter and wash Cu-Pb cleaner concentrate. Repulp.											
Condition	200	400	-	-	-	-	-	-	5	-	9.5
	-	-	450	800	-	-	-	-	5	-	4.5
Cu Rougher	-	-	-	-	2.5	5	-	-	5	2	-
	-	-	-	-	1.3	1	-	-	1	1	-
Cu 1st Cleaner	-	50	-	60	-	1	-	-	3	2	4.5
Cu 2nd Cleaner	-	50	-	40	-	1	-	-	3	1.5	4.5
Cu 3rd Cleaner	-	50	-	30	-	1	-	-	3	1	4.0
Pb Upgrading											
Heat to 85°C											
Pyrite Rougher	-	-	-	-	-	5	20	-	1	3	-
Pyrite 1st Cl.	-	-	-	-	-	2	-	-	1	2	-
Pyrite 2nd Cl.	-	-	-	-	-	2	-	-	1	2	-

Conditions:

Stage	Reagents Added, grams per tonne				Time, minutes			pH
	$Ca(OH)_2$	$CuSO_4$	A343	MIBC	Grind	Cond.	Froth	
Pb Concentrate Dezincing								
Filter pyrite rougher tailing and repulp.								
Condition	250	-	-	-	-	10	-	-
	-	50	-	-	-	10	-	11.5
Zn Rougher	-	-	5	2	-	1	2	-
Zn Cleaner	100	-	-	1	-	2	1	12.0

Test No. 128 - Continued

Metallurgical Results

Product	Weight %	Assays, %			% Distribution		
		Cu	Pb	Zn	Cu	Pb	Zn
1. Cu Cleaner Concentrate	0.64	10.2	38.3	4.05	33.5	6.8	0.3
2. Cu 3rd Cleaner Tail.	0.32	3.19	47.5	5.55	5.2	4.2	0.2
3. Cu 2nd Cleaner Tail.	0.50	2.25	44.9	6.47	5.8	6.2	0.4
4. Cu 1st Cleaner Tail.	0.91	1.49	35.6	7.69	7.0	8.9	0.8
5. Zn Ro. Tail.(Pb Conc.)	1.41	0.75	41.4	14.3	5.4	16.1	2.2
6. Zn Cleaner Tailing	1.23	0.70	39.6	14.4	4.4	13.4	1.9
7. Zn Cleaner Concentrate	0.85	0.57	26.5	28.3	2.5	6.2	2.6
8. Py. 1st Cleaner Tail.	1.10	0.48	11.7	3.99	2.7	3.5	0.5
9. Py. 2nd Cleaner Tail.	0.52	0.37	8.85	2.97	1.0	1.3	0.2
10. Pyrite Cleaner Conc.	2.05	0.63	6.85	2.13	6.6	3.9	0.5
11. Cu-Pb 3rd Cl. Tail.	1.92	0.24	5.11	12.5	2.4	2.7	2.6
12. Cu-Pb 2nd Cl. Tail.	5.86	0.15	2.93	11.9	4.5	4.7	7.6
13. Cu-Pb 1st Cl. Tail.	13.96	0.073	1.37	11.8	5.2	5.3	17.9
14. Cu-Pb Rougher Tail.	68.73	0.039	0.89	8.33	13.8	16.8	62.3
Head (Calculated)	100.00	0.19	3.63	9.18	100.0	100.0	100.0

Calculated Grades and Recoveries

Products 1 and 2	0.96	7.86	41.4	4.55	38.7	11.0	0.5
Products 1 to 3	1.46	5.95	42.6	5.21	44.5	17.2	0.9
Products 1 to 4	2.37	4.24	39.9	6.16	51.5	26.1	1.7
Products 5 and 6	2.64	0.73	40.6	14.3	9.8	29.5	4.1
Products 5 to 7	3.49	0.69	37.1	17.7	12.3	35.7	6.7
Products 5 to 8	4.59	0.64	31.0	14.4	15.0	39.2	7.2
Products 5 to 9	5.11	0.61	28.8	13.3	16.0	40.5	7.4
Products 5 to 10	7.16	0.62	22.5	10.1	22.6	44.4	7.9
Products 1 to 10	9.53	1.52	26.8	9.11	74.1	70.5	9.6
Products 1 to 11	11.45	1.30	23.2	9.68	76.5	73.2	12.2
Products 1 to 12	17.31	0.91	16.3	10.4	81.0	77.9	19.8
Products 1 to 13	31.27	0.54	9.65	11.0	86.2	83.2	37.7

Test No. 129

Purpose: To repeat test No. 128, but with a different Cu-Pb separation procedure.

Procedure: As for test No. 127, but only one copper cleaner and omit zinc flotation.

Feed: Two 2000 gram charges minus 10 mesh Composite No. 4A.

Grind: 40 minutes per charge at 66 % solids in the laboratory ball mill.

Conditions:

Stage	Reagents Added, g/tonne					Time, minutes			pH
	Na_2CO_3	LS-3	343/350	241	MIBC	Grind	Cond.	Froth	
Primary Grind	3000	150	-	-	-	80	-	-	-
Combine ground charges									
Aeration	250	-	-	-	-	-	30	-	9.2
Cu-Pb Rougher	250	-	10	10	7.5	-	1	2	9.2
	200	-	10	10	-	-	1	2	-
	250	-	10	10	-	-	1	2	-
	250	-	10	10	-	-	1	2	-
Conc. Regrind	500	30	-	-	-	30	-	-	-
Cu-Pb 1st Cl.	250	-	2.5	-	2.5	-	1	3	9.6
	-	-	2.5	-	2.5	-	1	3	-
Cu-Pb 2nd Cl.	250	15	-	-	-	-	1	2	9.6
	-	-	2	-	2	-	1	3	-
Cu-Pb 3rd Cl.	250	15	-	-	2	-	1	4	9.6

Test No. 129 - Continued

Conditions:

Stage	Reagents Added, grams per tonne								Time, minutes			pH
	Reagent B	A.C.	H-31	A325	MIBC	SO_2	A343	DF-250	Grind	Cond.	Froth	
Cu-Pb Separation												
Filter and wash Cu-Pb cleaner concentrate. Repulp.												
Condition	500	500	-	-	-	-	-	-	-	15	-	9.0
	200	-	50	-	-	-	-	-	-	10	-	-
Cu Rougher	-	-	-	1	10	-	-	-	-	1	3	-
Cu 1st Cleaner	200	100	-	-	-	-	-	-	-	10	-	-
	-	-	-	-	2.5	-	-	-	-	1	2	-
Pb Upgrading												
Condition	-	-	-	-	-	250	-	-	-	2	-	4.5
Heat to 85°C	-	-	-	-	-	-	-	-	-	10	-	-
Pyrite Rougher	-	-	-	-	-	-	45	10	-	1	3	-
Pyrite 1st Cl.	-	-	-	-	-	40	-	-	-	2	2	4.5
Pyrite 2nd Cl.	-	-	-	-	-	30	-	-	-	2	1.5	4.5

Test No. 129 - Continued

Metallurgical Results

Product	Weight	Assays, %			% Distribution		
	%	Cu	Pb	Zn	Cu	Pb	Zn
1. Cu Cleaner Conc.	0.80	13.7	11.6	6.64	55.3	2.5	0.6
2. Cu Cleaner Tail.	0.69	1.77	23.4	9.22	6.2	4.4	0.7
3. Pyrite. Ro. Tail.	2.26	0.25	37.7	10.3	2.8	23.2	2.5
4. Py. 1st Cl. Tail.	1.73	0.21	41.8	16.8	1.8	19.7	3.1
5. Py. 2nd Cl. Tail.	0.48	0.54	22.7	19.7	1.3	3.0	1.0
6. Pyrite Cl. Conc.	5.69	0.28	11.9	4.83	8.0	18.5	3.0
7. Cu-Pb 3rd Cl. Tail.	2.56	0.16	4.76	10.9	2.1	3.3	3.0
8. Cu-Pb 2nd Cl. Tail.	7.02	0.11	2.95	11.0	3.9	5.6	8.3
9. Cu-Pb 1st Cl. Tail.	14.88	0.076	1.46	11.6	5.7	5.9	18.6
10. Cu-Pb Rougher Tail.	63.89	0.040	0.79	8.60	12.9	13.9	59.2
Head (Calculated)	100.00	0.20	3.67	9.28	100.0	100.0	100.0

Calculated Grades and Recoveries

Products 1 and 2	1.49	8.17	17.1	7.83	61.5	6.9	1.3
Products 3 and 4	3.99	0.23	39.5	13.1	4.6	42.9	5.6
Products 3 to 5	4.47	0.26	37.7	13.8	5.9	45.9	6.6
Products 3 to 6	10.16	0.27	23.2	8.79	13.9	64.4	9.6
Products 1 to 6	11.65	1.28	22.5	8.67	75.4	71.3	10.9
Products 1 to 7	14.21	1.08	19.3	9.07	77.5	74.6	13.9
Products 1 to 8	21.23	0.76	13.9	9.71	81.4	80.2	22.2
Products 1 to 9	36.11	0.48	8.76	10.5	87.1	86.1	40.8

Test No. 130

Purpose: To repeat tests No. 128 and 129, but 1st Cu-Pb separation using H-31 and SO_2 and clean Cu using Reagent B.

Procedure: As for test No. 127, but two copper cleaners, one pyrite cleaner and omit de-zincing.

Feed: Two 2000 gram charges minus 10 mesh Composite No. 4A.

Grind: 40 minutes per charge at 66 % solids in the laboratory ball mill.

Conditions:

Stage	Reagents Added, g/tonne					Time, minutes			pH
	Na_2CO_3	LS-3	343/350	241	MIBC	Grind	Cond.	Froth	
Primary Grind	3000	150	-	-	-	80	-	-	-
Combine ground charges.									
Aeration	250	-	-	-	-	-	30	-	9.2
Cu-Pb Rougher	250	-	10	10	7.5	-	1	2	9.2
	200	-	10	10	-	-	1	2	-
	250	-	10	10	-	-	1	2	-
	250	-	10	10	-	-	1	2	-
Conc. Regrind	500	30	-	-	-	30	-	-	-
Cu-Pb 1st Cl.	250	-	2.5	-	2.5	-	1	3	9.6
	-	-	2.5	-	2.5	-	1	3	-
Cu-Pb 2nd Cl.	250	15	-	-	-	-	1	2	9.6
	-	-	2	-	2	-	1	3	-
Cu-Pb 3rd Cl.	250	15	-	-	1	-	1	4	9.6

Test No. 130 - Continued

Conditions:

Stage	Reagents Added, grams per tonne										Time, minutes			pH
	Na_2-CO_3	H-31	A.C.	SO_2	M2030	R-B	A325	MIBC	A-343	DF-250	Grind	Cond.	Froth	
Cu-Pb Separation														
Filter and wash Cu-Pb cleaner concentrate. Repulp.														
Condition	200	-	500	-	-	-	-	-	-	-	-	5	-	9.5
	-	400	-	-	-	-	-	-	-	-	-	5	-	-
	-	-	-	800	-	-	-	-	-	-	-	5	-	4.5
Cu Rougher	-	-	-	-	5	-	-	2	-	-	-	5	2	-
	-	-	-	-	1.3	-	-	1	-	-	-	1	1	-
Filter concentrate and repulp														
Cu 1st Cl.	-	-	100	-	-	300	-	5	-	-	-	15	1	-
	-	-	-	-	-	-	2	1	-	-	-	1	1	-
Cu 2nd Cl.	-	-	50	-	-	150	-	-	-	-	-	15	1	-
	-	-	-	-	-	-	-	2	-	-	-	1	1	-
Pb Upgrading														
Heat to 85°C	-	-	-	-	-	-	-	-	-	-	-	5	-	-
Hold Temp.	-	-	-	-	-	-	-	-	-	-	-	10	-	-
Pyrite Ro.	-	-	-	-	-	-	-	-	10	5	-	0.5	2	-
Pyrite Cl.	-	-	-	-	-	-	-	-	-	1	-	0.5	1.5	-

Test No. 130 - Continued

Metallurgical Results

Product	Weight %	Assays, %			% Distribution		
		Cu	Pb	Zn	Cu	Pb	Zn
1. Cu Cleaner Concentrate	0.43	12.5	26.0	4.75	27.1	3.0	0.2
2. Cu 2nd Cl. Tailing	0.63	2.73	41.3	6.17	8.7	7.0	0.4
3. Cu 1st Cl. Tailing	1.05	0.92	37.4	6.99	4.9	10.6	0.8
4. Py. Ro. Tail. (Pb Conc.)	3.41	1.17	42.2	19.8	20.1	38.9	7.2
5. Py. Cleaner Tailing	0.77	1.60	20.2	7.48	6.2	4.2	0.6
6. Py. Cleaner Concentrate	4.69	0.37	5.80	2.01	8.8	7.3	1.0
7. Cu-Pb 3rd Cl. Tailing	2.12	0.18	5.11	11.0	1.9	2.9	2.5
8. Cu-Pb 2nd Cl. Tailing	5.98	0.14	3.27	11.8	4.2	5.3	7.5
9. Cu-Pb 1st Cl. Tailing	14.15	0.059	1.55	12.0	4.2	5.9	18.1
10. Cu-Pb Rougher Tailing	66.77	0.042	0.82	8.69	13.9	14.9	61.7
Head (Calculated)	100.00	0.20	3.70	9.40	100.0	100.0	100.0

Calculated Grades and Recoveries

Products 1 and 2	1.06	6.70	35.1	5.59	35.8	10.0	0.6
Products 1 to 3	2.11	3.82	36.2	6.29	40.7	20.6	1.4
Products 4 and 5	4.18	1.25	38.1	17.5	26.3	43.1	7.8
Products 4 to 6	8.87	0.78	21.0	9.32	35.1	50.4	8.8
Products 1 to 6	10.98	1.37	24.0	8.74	75.8	71.0	10.2
Products 1 to 7	13.10	1.18	20.9	9.11	77.7	73.9	12.7
Products 1 to 8	19.08	0.85	15.4	9.95	81.9	79.2	20.2
Products 1 to 9	33.23	0.51	9.49	10.8	86.1	85.1	38.3

Test No. 131

Purpose:	To repeat test No. 40, but reduce collector additions and flotation times and clean the rougher concentraze.
Procedure:	Grind, aerate and float a rougher concentrate. Clean the concnetrate twice.
Feed:	2000 grams minus 10 mesh Composite No. 2.
Grind:	25 minutes at 66 % solids in the laboratory ball mill.

Conditions:

Stage	Reagents Added, g/tonne					Time, minutes			pH
	SO_2	$Ca(OH)_2$	R208	R317	MIBC	Grind	Cond.	Froth	
Grind	-	-	-	-	-	25	-	-	-
Aeration	850	-	-	-	-	-	10	-	5.5
Condition	-	2000	-	-	-	-	3	-	10.5
Cu Rougher	-	-	10	5	15	-	2	3	-
	-	-	5	2.5	2.5	-	1	2	-
	-	-	5	2.5	2.5	-	1	2	-
Cu 1st Cl.	250	-	-	-	-	-	5	-	5.5
	-	100	-	-	-	-	2	2	6.5
	-	-	2.5	2.5	2.5	-	1	3	-
Cu 2nd Cl.	150	-	-	-	-	-	5	-	5.5
	-	75	-	-	-	-	2	2	6.5
	-	-	2.5	-	-	-	1	2	-

Stage	Aeration	Rougher	Cleaners
Flotation Cell	1000 g D - 1	1000 g D - 1	500 g D - 1
Speed: r.p.m.	2000	1800	1300
% Solids	35	33	-

Test No. 131 - Continued

Metallurgical Results

Product	Weight %	Assays, %		% Distribution	
		Cu	Zn	Cu	Zn
1. Cu Cleaner Conc.	12.40	20.4	5.38	93.9	14.8
2. Cu 2nd Cl. Tail.	3.37	0.84	7.39	1.1	5.5
3. Cu 1st Cl. Tail.	10.64	0.24	4.49	0.9	10.6
4. Cu Rougher Tail.	73.59	0.15	4.22	4.1	69.1
Head (Calculated)	100.00	2.69	4.50	100.0	100.0

Calculated Grades and Recoveries

Products 1 and 2	15.77	16.22	5.81	95.0	20.3
Products 1 to 3	26.41	9.78	5.28	95.9	30.9

Test No. 132

Purpose: To repeat test No. 131, but add depressant LS-1 to rougher and cleaners.

Procedure: As for test No. 131.

Feed: 2000 grams minus 10 mesh Composite No. 2.

Grind: 25 minutes at 66 % solids in the laboratory ball mill.

Conditions:

Stage	Reagents Added, grams per tonne						Time, minutes			pH
	LS-1	SO_2	$Ca(OH)_2$	R208	R317	MIBC	Grind	Cond.	Froth	
Grind	150	-	-	-	-	-	25	-	-	-
Aeration	-	800	-	-	-	-	-	10	-	5.5
Condition	-	-	2200	-	-	-	-	3	-	10.5
Cu Rougher	-	-	-	10	5	15	-	2	3	-
	-	-	-	5	2.5	2.5	-	1	2	-
	-	-	-	5	2.5	2.5	-	1	2	-
Cu 1st Cl.	30	230	-	-	-	-	-	5	-	5.5
	-	-	100	-	-	-	-	2	2	6.5
	-	-	-	2.5	2.5	-	-	1	3	-
Cu 2nd Cl.	20	150	-	-	-	-	-	5	-	5.5
	-	-	75	-	-	-	-	2	2	6.5
	-	-	-	2.5	-	-	-	1	2	-

Test No. 132 - Continued

Metallurgical Results

Product	Weight %	Assays, %		% Distribution	
		Cu	Zn	Cu	Zn
1. Cu Cleaner Conc.	10.18	23.6	4.07	88.3	9.2
2. Cu 2nd Cl. Tail.	3.79	3.02	8.57	4.2	7.2
3. Cu 1st Cl. Tail.	11.62	0.48	4.83	2.1	12.5
4. Cu Rougher Tail.	74.41	0.20	4.31	5.4	71.1
Head (Calculated)	100.00	2.72	4.51	100.0	100.0

Calculated Grades and Recoveries

Products 1 and 2	13.97	18.02	5.29	92.5	16.4
Products 1 to 3	25.59	10.05	5.08	94.6	28.9

Test No. 133

Purpose: To repeat test No. 131, but add depressant LS-2 to rougher and cleaners.

Procedure: As for test No. 131.

Feed: 2000 grams minus 10 mesh Composite No. 2.

Grind: 25 minutes at 66 % solids in the laboratory ball mill.

Conditions:

Stage	Reagents Added, grams per tonne						Time, minutes			pH
	LS-2	SO_2	$Ca(OH)_2$	R208	R317	MIBC	Grind	Cond.	Froth	
Grind	150	-	-	-	-	-	25	-	-	-
Aeration	-	800	-	-	-	-	-	10	-	5.5
Condition	-	-	2200	-	-	-	-	3	-	10.5
Cu Rougher	-	-	-	10	5	10	-	2	3	-
	-	-	-	5	2.5	2.5	-	1	2	-
	-	-	-	5	2.5	2.5	-	1	2	-
Cu 1st Cl.	30	220	-	-	-	-	-	5	-	5.5
	-	-	100	-	-	-	-	2	2	6.5
	-	-	-	2.5	2.5	-	-	1	3	-
Cu 2nd Cl.	20	150	-	-	-	-	-	5	-	5.5
	-	-	70	-	-	-	-	2	2	6.5
	-	-	-	2.5	-	-	-	1	2	-

Test No. 133 - Continued

Metallurgical Results

Product	Weight	Assays, %		% Distribution	
	%	Cu	Zn	Cu	Zn
1. Cu Cleaner Conc.	10.21	23.8	4.34	88.6	9.7
2. Cu 2nd Cl. Tail.	4.02	3.14	9.10	4.6	8.0
3. Cu 1st Cl. Tail.	10.28	0.48	4.69	1.8	10.5
4. Cu Rougher Tail.	75.49	0.18	4.36	5.0	71.8
Head (Calculated)	100.00	2.74	4.58	100.0	100.0

Calculated Grades and Recoveries

Products 1 and 2	14.23	17.96	5.68	93.2	17.7
Products 1 to 3	24.51	10.63	5.27	95.0	28.2

Test No. 134

Purpose: To repeat test No. 131, but add depressant LS-3 to rougher and cleaners.

Procedure: As for test No. 131.

Feed: 2000 grams minus 10 mesh Composite No. 2.

Grind: 25 minutes at 66 % solids in the laboratory ball mill.

Conditions:

Stage	Reagents Added, grams per tonne						Time, minutes			pH
	LS-3	SO_2	$Ca(OH)_2$	R208	R317	MIBC	Grind	Cond.	Froth	
Grind	150	-	-	-	-	-	25	-	-	-
Aeration	-	800	-	-	-	-	-	10	-	5.5
Condition	-	-	2250	-	-	-	-	3	-	10.5
Cu Rougher	-	-	-	10	5	10	-	2	3	-
	-	-	-	5	2.5	2.5	-	1	2	-
	-	-	-	5	2.5	2.5	-	1	2	-
Cu 1st Cl.	30	220	-	-	-	-	-	5	-	5.5
	-	-	100	-	-	-	-	2	2	6.5
	-	-	-	2.5	2.5	-	-	1	3	-
Cu 2nd Cl.	20	150	-	-	-	-	-	5	-	-
	-	-	70	-	-	-	-	2	2	5.5
	-	-	-	2.5	-	-	-	1	2	6.5

Test No. 134 - Continued

Metallurgical Results

Product	Weight %	Assays, %		% Distribution	
		Cu	Zn	Cu	Zn
1. Cu Cleaner Conc.	9.88	24.7	4.38	88.9	9.9
2. Cu 2nd Cl. Tail.	1.77	3.54	8.64	2.3	3.5
3. Cu 1st Cl. Tail.	9.27	0.65	5.01	2.2	10.6
4. Cu Rougher Tail.	79.08	0.23	4.19	6.6	76.0
Head (Calculated)	100.00	2.75	4.36	100.0	100.0

Calculated Grades and Recoveries

Products 1 and 2	11.65	21.49	5.03	91.2	13.4
Products 1 to 3	20.92	12.25	5.02	93.4	24.0

Test No. 135

Purpose: To repeat test No. 131, but add depressant LS-7 to rougher and cleaners.

Procedure: As for test No. 131.

Feed: 2000 grams minus 10 mesh Composite No. 2.

Grind: 25 minutes at 66 % solids in the laboratory ball mill.

Conditions:

Stage	Reagents Added, grams per tonne						Time, minutes			pH
	LS-7	SO_2	$Ca(OH)_2$	R208	R317	MIBC	Grind	Cond.	Froth	
Grind	150	-	-	-	-	-	25	-	-	-
Aeration	-	800	-	-	-	-	-	10	-	5.5
Condition	-	-	2300	-	-	-	-	3	-	10.5
Cu Rougher	-	-	-	10	5	10	-	2	3	-
	-	-	-	5	2.5	2.5	-	1	2	-
	-	-	-	5	2.5	2.5	-	1	2	-
Cu 1st Cl.	30	250	-	-	-	-	-	5	-	5.5
	-	-	100	-	-	-	-	2	2	6.5
	-	-	-	2.5	2.5	2.5	-	1	3	-
Cu 2nd Cl.	20	160	-	-	-	-	-	5	-	5.5
	-	-	75	-	-	-	-	2	2	6.5
	-	-	-	2.5	-	2.5	-	1	2	-

Test No. 135 - Continued

Metallurgical Results

Product	Weight	Assays, %		% Distribution	
	%	Cu	Zn	Cu	Zn
1. Cu Cleaner Conc.	10.01	24.7	4.65	88.2	10.4
2. Cu 2nd Cl. Tail.	2.75	3.55	10.0	3.5	6.1
3. Cu 1st Cl. Tail.	8.57	0.62	4.74	1.9	9.1
4. Cu Rougher Tail.	78.67	0.23	4.24	6.4	74.4
Head (Calculated)	100.00	2.80	4.48	100.0	100.0

Calculated Grades and Recoveries

Products 1 and 2	12.76	20.14	5.80	91.7	16.5
Products 1 to 3	21.33	12.30	5.38	93.6	25.6

Test No. 136

Purpose: To repeat test No. 131, but add depressant LS-8 to rougher and cleaners.

Procedure: As for test No. 131.

Feed: 2000 grams minus 10 mesh Composite No. 2.

Grind: 25 minutes at 66 % solids in the laboratory ball mill.

Conditions:

Stage	Reagents Added, grams per tonne						Time, minutes			pH
	LS-8	SO_2	$Ca(OH)_2$	R208	R317	MIBC	Grind	Cond.	Froth	
Grind	150	-	-	-	-	-	25	-	-	-
Aeration	-	800	-	-	-	-	-	10	-	5.5
Condition	-	-	2400	-	-	-	-	3	-	10.5
Cu Rougher	-	-	-	10	5	10	-	2	3	-
	-	-	-	5	2.5	2.5	-	1	2	-
	-	-	-	5	2.5	2.5	-	1	2	-
Cu 1st Cl.	30	250	-	-	-	-	-	5	-	5.5
	-	-	100	-	-	-	-	2	2	6.5
	-	-	-	2.5	2.5	2.5	-	1	3	-
Cu 2nd Cl.	20	150	-	-	-	-	-	5	-	5.5
	-	-	65	-	-	-	-	2	2	6.5
	-	-	-	2.5	-	2.5	-	1	2	-

Test No. 136 - Continued

Metallurgical Results

Product	Weight	Assays, %		% Distribution	
	%	Cu	Zn	Cu	Zn
1. Cu Cleaner Conc.	10.03	24.2	4.29	87.3	9.5
2. Cu 2nd Cl. Tail.	3.82	3.38	8.92	4.6	7.6
3. Cu 1st Cl. Tail.	9.39	0.51	4.92	1.7	10.2
4. Cu Rougher Tail.	76.76	0.23	4.27	6.4	72.7
Head (Calculated)	100.00	2.78	4.51	100.0	100.0

Calculated Grades and Recoveries

Products 1 and 2	13.85	18.46	5.57	91.9	17.1
Products 1 to 3	23.24	11.21	5.31	93.6	27.3

Test No. 137

Purpose: To repeat test No. 131, but reduce SO_2 and lime additions to the rougher, regrind the rougher concentrate prior to cleaning and add a third cleaner stage.

Procedure: Grind, aerate and float a copper rougher concentrate. Regrind the concentrate and clean three times.

Feed: 2000 grams minus 10 mesh Composite No. 2.

Grind: 25 minutes at 66 % solids in the laboratory ball mill.

Conditions:

Stage	Reagents Added, g/tonne					Time, minutes			pH
	SO_2	$Ca(OH)_2$	R208	R317	MIBC	Grind	Cond.	Froth	
Primary Grind	-	-	-	-	-	25	-	-	7.3
Aeration	600	-	-	-	-	-	10	-	5.8- 6.8
Condition	-	800	-	-	-	-	3	-	10.1
Cu Rougher	-	-	10	5	15	-	2	3	-
	-	-	5	5	2.5	-	1	2	-
	-	-	5	5	2.5	-	1	2	-
Conc. Regr.	-	-	-	-	-	10	-	-	-
Condition	400	-	-	-	-	-	5	-	5.5
Cu 1st Cl.	-	50	-	-	5	-	2	3	6.1
	-	-	5	2.5	2.5	-	1	3	-
Cu 2nd Cl.	200	-	-	-	-	-	5	-	5.5
	-	40	-	-	-	-	2	2	6.0
	-	-	5	-	2.5	-	1	2.5	-
Cu 3rd Cl.	120	-	-	-	-	-	5	-	5.5
	-	30	-	-	-	-	2	3	6.0

Stage	Aeration	Rougher	Regrind	Cleaners
Flotation Cell	1000 g D - 1	1000 g D - 1	Pebble Mill	500 g D - 1
Speed: r.p.m.	2000	1800	-	1300
% Solids	35	33	-	-

Test No. 137 - Continued

Metallurgical Results

Product	Weight %	Assays, %		% Distribution	
		Cu	Zn	Cu	Zn
1. Cu Cleaner Conc.	8.59	24.4	6.62	75.5	12.8
2. Cu 3rd Cl. Tail.	4.62	11.8	13.5	19.6	14.0
3. Cu 2nd Cl. Tail.	4.78	1.03	17.7	1.8	19.0
4. Cu 1st Cl. Tail.	11.69	0.24	11.8	1.0	31.0
5. Cu Rougher Tail.	70.32	0.081	1.47	2.1	23.2
Head (Calculated)	100.00	2.78	4.45	100.0	100.0

Calculated Grades and Recoveries

Products 1 and 2	13.21	20.0	9.03	95.1	26.8
Products 1 to 3	17.99	14.95	11.3	96.9	45.8
Products 1 to 4	29.68	9.16	11.5	97.9	76.8

Test No. 138

Purpose: To repeat test No. 137, but add depressant LS-3 to rougher and cleaners. Also decrease collector to rougher and increase collector to cleaners.

Procedure: As for test No. 137.

Feed: 2000 grams minus 10 mesh Composite No. 2.

Grind: 25 minutes at 66 % solids in the laboratory ball mill.

Conditions:

Stage	Reagents Added, grams per tonne						Time, minutes			pH
	LS-3	SO_2	$Ca(OH)_2$	R208	R317	MIBC	Grind	Cond.	Froth	
Prim. Grind	150	-	-	-	-	-	25	-	-	7.2
Aeration	-	600	-	-	-	-	-	10	-	5.7- 6.7
Condition	-	-	800	-	-	-	-	3	-	9.8
Cu Rougher	-	-	-	10	5	15	-	2	3	-
	-	-	-	5	2.5	2.5	-	1	2	-
	-	-	-	5	-	2.5	-	1	1	-
Conc. Regr.	30	-	-	-	-	-	10	-	-	-
Condition	-	450	-	-	-	-	-	5	-	5.5
Cu 1st Cl.	-	-	50	2.5	-	5	-	2	3	6.0
	-	-	-	5	2.5	2.5	-	1	3	-
	-	-	-	5	-	2.5	-	1	2	-
Cu 2nd Cl.	20	100	-	-	-	-	-	5	-	5.5
	-	-	40	2.5	-	-	-	2	2	6.0
	-	-	-	2.5	-	2.5	-	1	2	-
	-	-	-	-	2.5	2.5	-	1	2	-
Cu 3rd Cl.	15	25	-	-	-	-	-	3	-	6.8
	-	-	-	-	2.5	-	-	1	2	-
	-	-	-	2.5	-	2.5	-	1	2	-

Test No. 138 - Continued

Metallurgical Results

Product	Weight	Assays, %		% Distribution	
	%	Cu	Zn	Cu	Zn
1. Cu Cleaner Conc.	8.84	27.5	5.75	87.0	11.3
2. Cu 3rd Cl. Tail.	1.33	6.23	7.00	2.9	2.1
3. Cu 2nd Cl. Tail.	2.90	2.77	10.50	2.8	6.8
4. Cu 1st Cl. Tail.	5.88	1.57	10.10	3.2	13.2
5. Cu Rougher Tail.	81.05	0.15	3.70	4.1	66.6
Head (Calculated)	100.00	2.81	4.50	100.0	100.0

Calculated Grades and Recoveries

Products 1 and 2	10.17	24.72	5.91	89.9	13.4
Products 1 to 3	13.07	19.85	6.93	92.7	20.2
Products 1 to 4	18.95	14.17	7.91	95.9	33.4

Test No. 139

Purpose: To repeat test No. 137, but add depressant LS-8 to rougher and cleaners.

Procedure: As for test No. 137.

Feed: 2000 grams minus 10 mesh Composite No. 2.

Grind: 25 minutes at 66 % solids in the laboratory ball mill.

Conditions:

Stage	Reagents Added, grams per tonne						Time, minutes			pH
	LS-8	SO_2	$Ca(OH)_2$	R208	R317	MIBC	Grind	Cond.	Froth	
Prim. Grind	150	-	-	-	-	-	25	-	-	-
Aeration	-	600	-	-	-	-	-	10	-	6.0-6.9
Condition	-	-	800	-	-	-	-	3	-	9.9
Cu Rougher	-	-	-	10	5	15	-	2	3	-
	-	-	-	5	2.5	2.5	-	1	2	-
	-	-	-	5	-	2.5	-	1	1	-
Conc. Regr.	30	-	-	-	-	-	10	-	-	5.5
Condition	-	500	-	-	-	-	-	2	-	6.0
Cu 1st Cl.	-	-	50	2.5	-	5	-	2	3	-
	-	-	-	2.5	2.5	2.5	-	1	3	-
	-	-	-	-	-	-	-	1	2	5.5
Cu 2nd Cl.	20	250	-	-	-	-	-	-	-	6.0
	-	-	40	2.5	-	2.5	-	2	2	-
	-	-	-	2.5	-	2.5	-	1	3	-
Cu 3rd Cl.	15	25	-	-	-	-	-	2	-	6.9
	-	-	-	-	2.5	-	-	1	2	-
	-	-	-	2.5	-	2.5	-	1	2	-

Test No. 139 - Continued

Metallurgical Results

Product	Weight %	Assays, %		% Distribution	
		Cu	Zn	Cu	Zn
1. Cu Cleaner Conc.	7.51	28.3	3.20	76.5	5.5
2. Cu 3rd Cl. Tail.	2.86	14.0	8.84	14.4	5.8
3. Cu 2nd Cl. Tail.	2.75	2.55	10.9	2.5	6.8
4. Cu 1st Cl. Tail.	6.97	0.66	8.08	1.6	12.8
5. Cu Rougher Tail.	79.91	0.17	3.80	5.0	69.1
Head (Calculated)	100.00	2.78	4.39	100.0	100.0

Calculated Grades and Recoveries

Products 1 and 2	10.37	25.35	4.76	90.9	11.3
Products 1 to 3	13.12	19.78	6.04	93.4	18.1
Products 1 to 4	20.09	13.15	6.75	95.0	30.9

Test No. 140

Purpose: To repeat test No. 138, but omit depressant LS-3.

Procedure: As for test No. 137.

Feed: 2000 grams minus 10 mesh Composite No. 2.

Grind: 25 minutes at 66 % solids in the laboratory ball mill.

Conditions:

Stage	Reagents Added, g/tonne					Time, minutes			pH
	SO_2	$Ca(OH)_2$	R208	R317	MIBC	Grind	Cond.	Froth	
Prim. Grind	-	-	-	-	-	25	-	-	7.3
Aeration	600	-	-	-	-	-	10	-	5.8- 6.3
Condition	-	800	-	-	-	-	3	-	10.3
Cu Rougher	-	-	10	5	15	-	2	3	-
	-	-	5	2.5	2.5	-	1	2	-
	-	-	5	-	2.5	-	1	1	-
Conc. Regr.	-	-	-	-	-	10	-	-	-
Condition	250	-	-	-	-	-	3	-	6.0
Cu 1st Cl.	-	-	2.5	-	2.5	-	2	3	6.5
	-	-	2.5	2.5	2.5	-	1	3	-
Cu 2nd Cl.	120	-	-	-	-	-	3	-	5.7
	-	-	2.5	-	-	-	1	3	6.0
	-	-	2.5	-	2.5	-	1	2	-
Cu 3rd Cl.	100	-	-	-	-	-	3	2	5.5
	-	-	2.5	-	2.5	-	1	2	5.7

Test No. 140 - Continued

Metallurgical Results

Product	Weight	Assays, %		% Distribution	
	%	Cu	Zn	Cu	Zn
1. Cu Cleaner Conc.	12.72	20.4	11.0	94.6	31.9
2. Cu 3rd Cl. Tail.	1.15	2.17	16.0	0.9	4.2
3. Cu 2nd Cl. Tail.	2.41	0.91	13.7	0.8	7.5
4. Cu 1st Cl. Tail.	6.73	0.35	6.40	0.9	9.8
5. Cu Rougher Tail.	76.99	0.10	2.65	2.8	46.6
Head (Calculated)	100.00	2.74	4.38	100.0	100.0

Calculated Grades and Recoveries

Products 1 and 2	13.87	18.9	11.4	95.5	36.1
Products 1 to 3	16.28	16.2	11.8	96.3	43.6
Products 1 to 4	23.01	11.6	10.2	97.2	53.4

Test No. 141

Purpose: To repeat test No. 140, but increase regrind time.

Procedure: As for test No. 137.

Feed: 2000 grams minus 10 mesh Composite No. 2.

Grind: 25 minutes at 66 % solids in the laboratory ball mill.

Conditions:

Stage	Reagents Added, g/tonne					Time, minutes			pH
	SO_2	$Ca(OH)_2$	R208	R317	MIBC	Grind	Cond.	Froth	
Prim. Grind	-	-	-	-	-	25	-	-	-
Aeration	600	-	-	-	-	-	10	-	5.7- 6.2
Condition	-	800	-	-	-	-	3	-	10.3
Cu Rougher	-	-	10	5	15	-	2	3	-
	-	-	5	2.5	2.5	-	1	2	-
	-	-	5	-	2.5	-	1	1	-
Conc. Regr.	-	-	-	-	-	20	-	-	-
Condition	250	-	-	-	-	-	3	-	5.9
Cu 1st Cl.	-	-	2.5	-	2.5	-	2	3	6.2
	-	-	2.5	2.5	2.5	-	1	3	-
Cu 2nd Cl.	120	-	-	-	-	-	3	-	5.6
	-	-	2.5	-	-	-	1	3	5.8
	-	-	2.5	-	2.5	-	1	2	-
Cu 3rd Cl.	100	-	-	-	-	-	3	2	5.4
	-	-	2.5	-	2.5	-	1	2	5.6

Test No. 141 - Continued

Metallurgical Results

Product	Weight %	Assays, %		% Distribution	
		Cu	Zn	Cu	Zn
1. Cu Cleaner Conc.	10.99	23.3	8.22	92.9	20.6
2. Cu 3rd Cl. Tail.	0.81	3.95	14.4	1.2	2.6
3. Cu 2nd Cl. Tail.	1.74	1.67	11.7	1.1	4.6
4. Cu 1st Cl. Tail.	8.28	0.58	10.6	1.7	19.9
5. Cu Flot. Tailing	78.18	0.11	2.93	3.8	52.3
Head (Calculated)	100.00	2.75	4.38	100.0	100.0

Calculated Grades and Recoveries

Products 1 and 2	11.80	21.96	8.64	93.4	23.2
Products 1 to 3	13.54	19.36	9.04	94.5	27.8
Products 1 to 4	21.82	12.23	9.60	96.2	47.7
Products 4 and 5	86.46	0.16	3.66	5.5	72.2

Test No. 142

Purpose: To repeat test No. 14, but add depressant LS-3.

Procedure: As for test No. 137.

Feed: 2000 grams minus 10 mesh Composite No. 2.

Grind: 25 minutes at 66 % solids in the laboratory ball mill.

Conditions:

Stage	Reagents Added, grams per tonne						Time, minutes			pH
	LS-3	SO_2	$Ca(OH)_2$	R208	R317	MIBC	Grind	Cond.	Froth	
Prim. Grind	150	-	-	-	-	-	25	-	-	7.2
Aeration	-	600	-	-	-	-	-	10	-	5.7-6.2
Condition	-	-	800	-	-	-	-	3	-	10.3
Cu Rougher	-	-	-	10	5	15	-	2	3	-
	-	-	-	5	2.5	2.5	-	1	2	-
	-	-	-	5	-	2.5	-	1	1	-
Conc. Regr.	30	-	-	-	-	-	20	-	-	-
Condition	-	250	-	-	-	-	-	3	-	5.8
Cu 1st Cl.	-	-	-	2.5	-	2.5	-	2	3	6.1
	-	-	-	2.5	2.5	2.5	-	1	3	-
Cu 2nd Cl.	20	120	-	-	-	-	-	3	-	5.7
	-	-	-	2.5	-	-	-	1	3	5.9
	-	-	-	2.5	-	2.5	-	1	2	-
Cu 3rd Cl.	15	100	-	-	-	-	-	3	2	5.4
	-	-	-	2.5	-	2.5	-	1	2	5.5

Test No. 142 - Continued

Metallurgical Results

Product	Weight	Assays, %		% Distribution	
	%	Cu	Zn	Cu	Zn
1. Cu Cleaner Conc.	9.60	26.3	6.35	90.2	13.7
2. Cu 3rd Cl. Tail.	1.24	5.28	16.10	2.3	4.5
3. Cu 2nd Cl. Tail.	3.28	1.93	14.00	2.2	10.3
4. Cu 1st Cl. Tail.	7.29	0.54	9.36	1.4	15.3
5. Cu Rougher Tail.	78.59	0.14	3.20	3.9	56.2
Head (Calculated)	100.00	2.80	4.46	100.0	100.0

Calculated Grades and Recoveries

Products 1 and 2	10.84	23.89	7.47	92.5	18.2
Products 1 to 3	14.12	18.79	8.98	94.7	28.5
Products 1 to 4	21.41	12.58	9.11	96.1	43.8
Products 4 and 5	85.88	0.16	3.72	5.3	71.5

Test No. 143

Purpose: To perform a preliminary test on Composite No. 3.

Procedure: Grind, aerate and float a Cu-Pb rougher concentrate. Regrind the concentrate and clean three times.

Feed: 2000 grams minus 10 mesh Composite No. 3.

Grind: 35 minutes at 66 % solids in the laboratory ball mill.

Conditions:

Stage	Reagents Added, g/tonne					Time, minutes			pH
	SO_2	$Ca(OH)_2$	R208	R317	MIBC	Grind	Cond.	Froth	
Prim. Grind	-	-	-	-	-	35	-	-	-
Aeration	660	-	-	-	-	-	10	-	6.0-6.3
Condition	-	1000	-	-	-	-	5	-	10.5
Cu-Pb Rougher	-	-	10	10	20	-	2	3	-
	-	-	10	10	5	-	1	3	-
	-	-	5	5	5	-	1	3	-
Conc. Regr.	-	250	-	-	-	5	-	-	-
Cu-Pb 1st Cl.	-	100	2.5	2.5	5	-	2	3	11.0
	-	-	5	5	2.5	-	1	3	-
Cu-Pb 2nd Cl.	-	150	-	-	-	-	2	2	11.0
	-	-	2.5	2.5	2.5	-	1	3	-
Cu-Pb 3rd Cl.	-	100	-	-	-	-	2	2	11.0
	-	-	5	-	2.5	-	1	2	-

Stage	Aeration	Rougher	Conc. Regrind	Cleaners
Flotation Cell	1000 g D - 1	1000 g D - 1	Rod Mill	500 g D - 1
Speed: r.p.m.	2000	1800	-	1300
% Solids	35	33	-	-

Test No. 143 - Continued

Metallurgical Results

Product	Weight %	Assays, %			% Distribution		
		Cu	Pb	Zn	Cu	Pb	Zn
1. Cu-Pb Cl. Conc.	10.62	5.19	5.41	10.1	91.3	45.0	15.3
2. Cu-Pb 3rd Cl. Tail.	3.05	0.32	8.69	12.4	1.6	20.8	5.4
3. Cu-Pb 2nd Cl. Tail.	3.11	0.17	1.15	7.27	0.9	2.8	3.2
4. Cu-Pb 1st Cl. Tail.	8.58	0.099	0.68	6.92	1.4	4.6	8.5
5. Cu-Pb Rougher Tail.	74.64	0.039	0.46	6.32	4.8	26.8	67.6
Head (Calculated)	100.00	0.60	1.28	6.99	100.0	100.0	100.0

Calculated Grades and Recoveries

Products 1 and 2	13.67	4.10	6.14	10.6	92.9	65.8	20.7
Products 1 to 3	16.78	3.37	5.22	9.99	93.8	68.6	23.9
Products 1 to 4	25.36	2.27	3.68	8.95	95.2	73.2	32.4

Screen Analyses

Cu-Pb Rougher Tailing

Mesh Size (Tyler)	% Retained		% Passing Cumulative
	Individual	Cumulative	
+ 100	0.5	0.5	99.5
150	2.8	3.3	96.7
200	6.9	10.2	89.8
270	12.8	23.0	77.0
400	12.7	35.7	64.3
- 400	64.3	100.0	-
Total	100.0	-	-

Test No. 144

Purpose: To repeat test No. 143, but with a coarser grind.

Procedure: As for test No. 143.

Feed: 2000 grams minus 10 mesh Composite No. 3.

Grind: 20 minutes at 66 % solids in the laboratory ball mill.

Conditions:

Stage	Reagents Added, grams per tonne					Time, minutes			pH
	SO_2	$Ca(OH)_2$	R-208	R-317	MIBC	Grind	Cond.	Froth	
Primary Grind	-	-	-	-	-	20	-	-	-
Aeration	660	-	-	-	-	-	10	-	5.9-6.3
Condition	-	950	-	-	-	-	5	-	10.5
Cu-Pb Ro.	-	-	10	10	15	-	2	3	-
	-	-	10	10	5	-	1	3	-
	-	-	5	5	5	-	1	3	-
Conc. Regr.	-	500	-	-	-	5	-	-	-
Cu-Pb 1st Cl.	-	-	2.5	2.5	5	-	1	3	11.0
	-	-	5	5	2.5	-	1	3	-
Cu-Pb 2nd Cl.	-	150	-	-	-	-	2	2	11.0
	-	-	2.5	2.5	2.5	-	1	3	-
Cu-Pb 3rd Cl.	-	100	-	-	-	-	2	2	11.0
	-	-	5	-	2.5	-	1	2	-

Test No. 144 - Continued

Metallurgical Results

Product	Weight %	Assays, % Cu	Assays, % Pb	Assays, % Zn	% Distribution Cu	% Distribution Pb	% Distribution Zn
1. Cu-Pb Cleaner Conc.	8.49	6.34	5.70	11.9	86.7	38.3	14.1
2. Cu-Pb 3rd Cl. Tail.	2.60	0.44	11.7	12.8	1.8	24.1	4.7
3. Cu-Pb 2nd Cl. Tail.	2.82	0.26	1.59	8.92	1.2	3.5	3.5
4. Cu-Pb 1st Cl. Tail.	7.22	0.13	0.73	9.29	1.5	4.2	9.4
5. Cu-Pb Rougher Tail.	78.87	0.069	0.48	6.19	8.8	29.9	68.3
Head (Calculated)	100.00	0.62	1.26	7.15	100.0	100.0	100.0

Calculated Grades and Recoveries

Products 1 and 2	11.09	4.96	7.11	12.1	88.5	62.4	18.8
Products 1 to 3	13.91	4.00	5.99	11.5	89.7	65.9	22.3
Products 1 to 4	21.13	2.68	4.19	10.7	91.2	70.1	31.7

Screen Analyses

Cu-Pb Rougher Tailing

Mesh Size (Tyler)	% Retained Individual	% Retained Cumulative	% Passing Cumulative
+ 65	2.4	2.4	97.6
100	5.3	7.7	92.3
150	11.8	19.5	80.5
200	13.9	33.4	66.6
270	13.2	46.6	53.4
400	10.8	57.4	42.6
- 400	42.6	100.0	-
Total	100.0	-	-

Test No. 145

Purpose: To repeat test No. 143, but add depressant LS-3.

Procedure: As for test No. 143.

Feed: 2000 grams minus 10 mesh Composite No. 3.

Grind: 35 minutes at 66 % solids in the laboratory ball mill.

Conditions:

Stage	Reagents Added, grams per tonne						Time, minutes			pH
	LS-3	SO_2	$Ca(OH)_2$	R-208	R-317	MIBC	Grind	Cond.	Froth	
Primary Grind	150	-	-	-	-	-	35	-	-	-
Aeration	-	660	-	-	-	-	-	10	-	6.1-6.3
Condition	-	-	1000	-	-	-	-	5	-	10.5
Cu-Pb Rougher	-	-	-	10	10	20	-	2	3	-
	-	-	-	10	10	5	-	1	3	-
	-	-	-	5	5	5	-	1	3	-
Conc. Regrind	30	-	500	-	-	-	5	-	-	-
Cu-Pb 1st Cl.	-	-	-	2.5	2.5	5	-	1	3	11.0
	-	-	-	5	5	2.5	-	1	3	-
Cu-Pb 2nd Cl.	20	-	150	-	-	-	-	2	2	11.0
	-	-	-	2.5	2.5	2.5	-	1	3	-
Cu-Pb 3rd Cl.	15	-	100	-	-	-	-	2	2	11.0
	-	-	-	5	-	2.5	-	1	2	-

Test No. 145 - Continued

Metallurgical Results

Product	Weight %	Assays, %			% Distribution		
		Cu	Pb	Zn	Cu	Pb	Zn
1. Cu-Pb Cleaner Conc.	8.70	6.09	4.30	10.2	89.0	29.3	12.8
2. Cu-Pb 3rd Cl. Tail.	3.35	0.50	11.7	11.1	2.8	30.7	5.4
3. Cu-Pb 2nd Cl. Tail.	3.67	0.22	2.50	9.94	1.4	7.2	5.3
4. Cu-Pb 1st Cl. Tail.	8.62	0.11	0.83	8.65	1.6	5.6	10.7
5. Cu-Pb Rougher Tail.	75.66	0.041	0.46	6.05	5.2	27.2	65.8
Head (Calculated)	100.00	0.60	1.28	6.95	100.0	100.0	100.0

Calculated Grades and Recoveries

Products 1 and 2	12.05	4.54	6.36	10.5	91.8	60.0	18.2
Products 1 to 3	15.72	3.53	5.46	10.3	93.2	67.2	23.5
Products 1 to 4	24.34	2.32	3.82	9.74	94.8	72.8	34.2

Test No. 146

Purpose: To repeat test No. 143, but add depressant LS-7.

Procedure: As for test No. 143.

Feed: 2000 grams minus 10 mesh Composite No. 3.

Grind: 35 minutes at 66 % solids in the laboratory ball mill.

Conditions:

Stage	Reagents Added, grams per tonne						Time, minutes			pH
	LS-7	SO_2	$Ca(OH)_2$	R-208	R-317	MIBC	Grind	Cond.	Froth	
Primary Grind	150	-	-	-	-	-	35	-	-	-
Aeration	-	660	-	-	-	-	-	10	-	6.2
Condition	-	-	1000	-	-	-	-	5	-	10.5
Cu-Pb Rougher	-	-	-	10	10	20	-	2	3	-
	-	-	-	10	10	5	-	1	3	-
	-	-	-	5	5	5	-	1	3	-
Conc. Regrind	30	-	500	-	-	-	5	-	-	-
Cu-Pb 1st Cl.	-	-	-	2.5	2.5	5	-	1	3	11.0
	-	-	-	5	5	2.5	-	1	3	-
Cu-Pb 2nd Cl.	20	-	150	-	-	-	-	2	2	11.0
	-	-	-	2.5	2.5	2.5	-	1	3	-
Cu-Pb 3rd Cl.	15	-	100	-	-	-	-	2	2	11.0
	-	-	-	5	-	2.5	-	1	2	-

Test No. 146 - Continued

Metallurgical Results

Product	Weight %	Assays, %			% Distribution		
		Cu	Pb	Zn	Cu	Pb	Zn
1. Cu-Pb Cleaner Conc.	8.27	6.41	6.43	11.0	87.5	40.6	12.7
2. Cu-Pb 3rd Cl. Tail.	3.38	0.73	8.17	11.9	4.1	21.0	5.6
3. Cu-Pb 2nd Cl. Tail.	3.66	0.22	1.51	8.62	1.3	4.2	4.4
4. Cu-Pb 1st Cl. Tail.	9.09	0.097	0.67	8.18	1.5	4.7	10.4
5. Cu-Pb Rougher Tail.	75.60	0.045	0.51	6.31	5.6	29.5	66.9
Head (Calculated)	100.00	0.61	1.31	7.14	100.0	100.0	100.0

Calculated Grades and Recoveries

Products 1 and 2	11.65	4.76	6.94	11.3	91.6	61.6	18.3
Products 1 to 3	15.31	3.68	5.63	10.6	92.9	65.8	22.7
Products 1 to 4	24.40	2.34	3.79	9.72	94.4	70.5	33.1

Test No. 147

Purpose: To repeat test No. 143, but add depressant LS-8.

Procedure: As for test No. 143.

Feed: 2000 grams minus 10 mesh Composite No. 3.

Grind: 35 minutes at 66 % solids in the laboratory ball mill.

Conditions:

Stage	Reagents Added, grams per tonne						Time, minutes			pH
	LS-8	SO_2	$Ca(OH)_2$	R-208	R-317	MIBC	Grind	Cond.	Froth	
Primary Grind	150	-	-	-	-	-	35	-	-	-
Aeration	-	660	-	-	-	-	-	10	-	6.2-6.6
Condition	-	-	1000	-	-	-	-	5	-	10.5
Cu-Pb Rougher	-	-	-	10	10	20	-	2	3	-
	-	-	-	10	10	5	-	1	3	-
	-	-	-	5	5	5	-	1	3	-
Conc. Regrind	30	-	500	-	-	-	5	-	-	-
Cu-Pb 1st Cl.	-	-	-	2.5	2.5	5	-	1	3	11.0
	-	-	-	5	5	2.5	-	1	3	-
Cu-Pb 2nd Cl.	20	-	150	-	-	-	-	2	2	11.0
	-	-	-	2.5	2.5	2.5	-	1	3	-
Cu-Pb 3rd Cl.	15	-	100	-	-	-	-	2	2	11.0
	-	-	-	5	-	2.5	-	1	2	-

Test No. 147 - Continued

Metallurgical Results

Product	Weight %	Assays, %			% Distribution		
		Cu	Pb	Zn	Cu	Pb	Zn
1. Cu-Pb Cleaner Conc.	8.82	5.97	5.73	10.9	89.1	40.2	13.7
2. Cu-Pb 3rd Cl. Tail.	3.22	0.48	9.51	12.4	2.6	24.4	5.7
3. Cu-Pb 2nd Cl. Tail.	3.72	0.22	1.52	7.94	1.4	4.5	4.2
4. Cu-Pb 1st Cl. Tail.	9.55	0.11	0.79	8.27	1.8	6.0	11.2
5. Cu-Pb Rougher Tail.	74.69	0.040	0.42	6.15	5.1	24.9	65.2
Head (Calculated)	100.00	0.59	1.26	7.04	100.0	100.0	100.0

Calculated Grades and Recoveries

Products 1 and 2	12.04	4.50	6.74	11.3	91.7	64.6	19.4
Products 1 to 3	15.76	3.49	5.51	10.5	93.1	69.1	23.6
Products 1 to 4	25.31	2.22	3.73	9.66	94.9	75.1	34.8

Test No. 148

Purpose: To repeat test No. 141, but increase SO_2 and $Ca(OH)_2$ additions to the rougher.

Procedure: As for test No. 137.

Feed: 2000 grams minus 10 mesh Composite No. 2.

Grind: 25 minutes at 66 % solids in the laboratory ball mill.

Conditions:

Stage	Reagents Added, g/tonne					Time, minutes			pH
	SO_2	$Ca(OH)_2$	R208	R317	MIBC	Grind	Cond.	Froth	
Prim. Grind	-	-	-	-	-	25	-	-	-
Aeration	800	-	-	-	-	-	10	-	5.5
Condition	-	1200	-	-	-	-	3	-	8.4
Cu Rougher	-	-	10	5	15	-	2	3	-
	-	-	5	2.5	2.5	-	1	2	-
	-	-	5	-	2.5	-	1	1	-
Conc. Regr.	-	-	-	-	-	20	-	-	-
Condition	300	-	-	-	-	-	3	-	5.5
Cu 1st Cl.	-	-	2.5	-	2.5	-	2	3	-
	-	-	2.5	2.5	2.5	-	1	3	-
Cu 2nd Cl.	120	-	-	-	-	-	3	-	5.5
	-	-	2.5	-	-	-	1	3	-
	-	-	2.5	-	2.5	-	1	2	-
Cu 3rd Cl.	100	-	-	-	-	-	3	2	5.5
	-	-	2.5	-	2.5	-	1	2	-

Test No. 148 - Continued

Metallurgical Results

Product	Weight	Assays, %		% Distribution	
	%	Cu	Zn	Cu	Zn
1. Cu Cleaner Conc. 2. Cu 3rd Cl. Tail. 3. Cu 2nd Cl. Tail. 4. Cu 1st Cl. Tail. 5. Cu Rougher Tail.	9.57 0.60 2.12 8.24 79.47	25.8 3.91 2.31 0.58 0.22	3.52 11.8 9.87 7.46 4.09	89.3 0.9 1.8 1.7 6.3	7.5 1.6 4.7 13.7 72.5
Head (Calculated)	100.00	2.76	4.48	100.0	100.0

Calculated Grades and Recoveries

Products 1 and 2	10.17	24.51	4.01	90.2	9.1
Products 1 to 3	12.29	20.68	5.02	92.0	13.8
Products 1 to 4	20.53	12.61	6.00	93.7	27.5
Products 4 and 5	87.71	0.25	4.41	8.0	86.2

Test No. 149

Purpose: To repeat test No. 148, but add a zinc circuit.

Procedure: Grind, aerate and float a copper rougher concentrate. Regrind the copper concentrate and clean three times. Combine the rougher and 1st cleaner tailings, condition and float a zinc concentrate. Clean the zinc concentrate three times.

Feed: 2000 grams minus 10 mesh Composite No. 2.

Grind: 25 minutes at 66 % solids in the laboratory ball mill.

Conditions:

Stage	Reagents Added, grams per tonne						Time, minutes			pH
	SO_2	$Ca(OH)_2$	R208	R317	MIBC	$CuSO_4$	Grind	Cond.	Froth	
Prim. Grind	-	-	-	-	-	-	25	-	-	-
Aeration	800	-	-	-	-	-	-	10	-	5.5
Condition	-	1200	-	-	-	-	-	3	-	8.5
Cu Rougher	-	-	10	5	15	-	-	2	3	-
	-	-	5	2.5	2.5	-	-	1	2	-
	-	-	5	-	2.5	-	-	1	1	-
Conc. Regr.	-	-	-	-	-	-	20	-	-	-
Condition	250	-	-	-	-	-	-	3	-	5.5
Cu 1st Cl.	-	-	2.5	-	2.5	-	-	2	3	-
	-	-	2.5	2.5	2.5	-	-	1	3	-
Cu 2nd Cl.	120	-	-	-	-	-	-	3	-	5.5
	-	-	2.5	-	-	-	-	1	3	-
	-	-	2.5	-	2.5	-	-	1	2	-
Cu 3rd Cl.	100	-	-	-	-	-	-	3	2	5.5
	-	-	2.5	-	2.5	-	-	1	2	-
Combine Cu rougher and 1st cleaner tailings for zinc flotation.										
Condition	-	1500	-	-	-	-	-	5	-	-
	-	-	-	-	-	450	-	5	-	11.5
Zn Rougher	-	-	10	10	5	-	-	1	3	-
	-	-	5	5	5	-	-	1	2	-
Zn 1st Cl.	-	250	-	-	-	-	-	2	2	11.6
	-	-	2.5	-	2.5	-	-	1	2	-
Zn 2nd Cl.	-	200	-	-	-	-	-	2	3	11.7
Zn 3rd Cl.	-	200	-	-	2.5	-	-	2	2	11.8

Test No. 149 - Continued

Metallurgical Results

Product	Weight	Assays, %		% Distribution		
	%	Cu	Zn	Cu	Zn	Zn Circuit
1. Cu Cleaner Conc.	9.98	25.0	5.16	90.9	11.5	-
2. Cu 3rd Cl. Tail.	0.43	4.00	12.4	0.6	1.2	-
3. Cu 2nd Cl. Tail.	1.93	2.47	10.5	1.7	4.5	-
4. Zn Cleaner Conc.	6.70	0.74	51.4	1.8	77.2	93.2
5. Zn 3rd Cl. Tail.	0.26	2.37	8.92	0.2	0.5	0.6
6. Zn 2nd Cl. Tail.	1.12	1.87	4.51	0.8	1.1	1.4
7. Zn 1st Cl. Tail.	3.00	0.58	1.00	0.6	0.7	0.8
8. Zn Rougher Tail.	76.58	0.12	0.19	3.4	3.3	4.0
Head (Calculated)	100.00	2.75	4.46	100.0	100.0	-

Calculated Grades and Recoveries

Products 1 and 2	10.41	24.13	5.46	91.5	12.7	-
Products 1 to 3	12.34	20.74	6.25	93.2	17.2	-
Products 4 and 5	6.96	0.80	49.81	2.0	77.7	93.8
Products 4 to 6	8.08	0.95	43.53	2.8	78.8	95.2
Products 4 to 7	11.08	0.85	32.02	3.4	79.5	96.0
Products 4 to 8	87.66	0.21	4.21	6.8	82.8	100.0

Test No. 150

Purpose: To repeat test No. 148, but add depressant LS-3.

Procedure: As for test No. 137.

Feed: 2000 grams minus 10 mesh Composite No. 2.

Grind: 25 minutes at 66 % solids in the laboratory ball mill.

Conditions:

Stage	Reagents Added, grams per tonne						Time, minutes			pH
	LS-3	SO_2	$Ca(OH)_2$	R208	R317	MIBC	Grind	Cond.	Froth	
Prim. Grind	150	-	-	-	-	-	25	-	-	-
Aeration	-	800	-	-	-	-	-	10	-	5.5
Condition	-	-	1200	-	-	-	-	3	-	9.7
Cu Rougher	-	-	-	10	5	15	-	2	3	-
	-	-	-	5	2.5	2.5	-	1	2	-
	-	-	-	5	-	2.5	-	1	1	-
Conc. Regr.	30	-	-	-	-	-	20	-	-	-
Condition	-	300	-	-	-	-	-	3	-	5.5
Cu 1st Cl.	-	-	-	2.5	-	2.5	-	2	3	-
	-	-	-	2.5	2.5	2.5	-	1	3	-
Cu 2nd Cl.	20	120	-	-	-	-	-	3	-	5.5
	-	-	-	2.5	-	-	-	1	3	-
	-	-	-	2.5	-	2.5	-	1	2	-
Cu 3rd Cl.	15	100	-	-	-	-	-	3	2	5.5
	-	-	-	2.5	-	2.5	-	1	2	-

Test No. 150 - Continued

Metallurgical Results

Product	Weight %	Assays, % Cu	Assays, % Zn	% Distribution Cu	% Distribution Zn
1. Cu Cleaner Conc.	8.48	28.3	3.51	86.8	6.5
2. Cu 3rd Cl. Tail.	1.27	7.59	13.6	3.5	3.8
3. Cu 2nd Cl. Tail.	2.30	3.13	11.5	2.6	5.8
4. Cu 1st Cl. Tail.	9.63	0.66	6.80	2.3	14.3
5. Cu Rougher Tail.	78.32	0.17	4.08	4.8	69.6
Head (Calculated)	100.00	2.76	4.59	100.0	100.0

Calculated Grades and Recoveries

Products 1 and 2	9.75	25.6	4.82	90.3	10.3
Products 1 to 3	12.05	21.31	6.10	92.9	16.1
Products 1 to 4	21.68	12.14	6.41	95.2	30.4
Products 4 and 5	87.95	0.22	4.38	7.1	83.9

Test No. 151

Purpose: To repeat test No. 150, but add the zinc circuit.

Procedure: As for test No. 149.

Feed: 2000 grams minus 10 mesh Composite No. 2.

Grind: 25 minutes at 66 % solids in the laboratory ball mill.

Conditions:

Stage	Reagents Added, grams per tonne							Time, minutes			pH
	LS-3	SO_2	$Ca(OH)_2$	R208	R317	MIBC	$CuSO_4$	Grind	Cond.	Froth	
Prim. Grind	150	-	-	-	-	-	-	25	-	-	-
Aeration	-	800	-	-	-	-	-	-	10	-	5.5
Condition	-	-	1200	-	-	-	-	-	3	-	-
Cu Rougher	-	-	-	10	5	15	-	-	2	3	-
	-	-	-	5	2.5	2.5	-	-	1	2	-
	-	-	-	5	-	2.5	-	-	1	1	-
Conc. Regr.	30	-	-	-	-	-	-	20	-	-	-
Condition	-	300	-	-	-	-	-	-	3	-	5.5
Cu 1st Cl.	-	-	-	2.5	-	2.5	-	-	2	3	-
	-	-	-	2.5	2.5	2.5	-	-	1	3	-
Cu 2nd Cl.	20	120	-	-	-	-	-	-	3	-	5.5
	-	-	-	2.5	-	-	-	-	1	3	-
	-	-	-	2.5	-	2.5	-	-	1	2	-
Cu 3rd Cl.	15	100	-	-	-	-	-	-	3	2	5.5
	-	-	-	2.5	-	2.5	-	-	1	2	-
Combine Cu rougher and 1st cleaner tailings for zinc flotation.											
Condition	100	-	1800	-	-	-	-	-	5	-	-
	-	-	-	-	-	-	550	-	5	-	11.5
Zn Rougher	-	-	-	10	10	5	-	-	1	3	-
	-	-	-	5	5	5	-	-	1	2	-
Zn 1st Cl.	20	-	750	-	-	-	-	-	2	2	12.0
	-	-	-	2.5	-	2.5	-	-	1	2	-
Zn 2nd Cl.	20	-	550	-	-	-	-	-	2	3	12.1
Zn 3rd Cl.	20	-	450	-	-	2.5	-	-	2	2	12.1

Test No. 151 - Continued

Metallurgical Results

Product	Weight %	Assays, %		% Distribution	
		Cu	Zn	Cu	Zn
1. Cu Cleaner Conc.	8.24	28.8	5.49	85.1	10.0
2. Cu 3rd Cl. Tail.	1.03	9.23	19.1	3.4	4.3
3. Cu 2nd Cl. Tail.	1.86	4.16	18.6	2.8	7.6
4. Zn Cleaner Conc.	7.22	1.33	45.5	3.4	72.4
5. Zn 3rd Cl. Tail.	1.09	2.04	6.11	0.8	1.5
6. Zn 2nd Cl. Tail.	1.23	1.58	2.90	0.7	0.8
7. Zn 1st Cl. Tail.	4.10	0.57	0.86	0.8	0.8
8. Zn Rougher Tail.	75.23	0.11	0.16	3.0	2.6
Head (Calculated)	100.00	2.79	4.54	100.0	100.0

Calculated Grades and Recoveries

Products 1 and 2	9.27	26.63	7.00	88.5	14.3
Products 1 to 3	11.13	22.87	8.94	91.3	21.9
Products 4 and 5	8.31	1.42	40.33	4.2	73.9
Products 4 to 6	9.54	1.44	35.51	4.9	74.7
Products 4 to 7	13.64	1.18	25.09	5.7	75.5
Products 4 to 8	88.87	0.27	3.99	8.7	78.1

Test No. 152

Purpose:	To repeat test No. 143, but reduce SO_2 and lime additions to the Cu-Pb rougher and clean at pH 10.
Procedure:	As for test No. 143.
Feed:	2000 grams minus 10 mesh Composite No. 3.
Grind:	35 minutes at 66 % solids in the laboratory ball mill.

Conditions:

Stage	Reagents Added, g/tonne					Time, minutes			pH
	SO_2	$Ca(OH)_2$	R208	R317	MIBC	Grind	Cond.	Froth	
Primary Grind	-	-	-	-	-	35	-	-	-
Aeration	400	-	-	-	-	-	10	-	6.2-6.6
Condition	-	800	-	-	-	-	5	-	9.9
Cu-Pb Ro.	-	-	10	10	20	-	2	3	-
	-	-	10	10	5	-	1	3	-
	-	-	5	5	5	-	1	3	-
Conc. Regrind	-	500	-	-	-	5	-	-	11.0
Cu-Pb 1st Cl.	150	-	2.5	2.5	5	-	2	3	10.0
	-	-	5	5	2.5	-	1	3	-
Cu-Pb 2nd Cl.	-	150	-	-	-	-	2	-	10.8
	100	-	-	-	-	-	1	2	10.0
	-	-	2.5	2.5	2.5	-	1	3	-
Cu-Pb 3rd Cl.	-	100	-	-	-	-	2	-	10.7
	70	-	-	-	2.5	-	1	2	10.0
	-	-	-	2.5	2.5	-	1	2	-

Test No. 152 - Continued

Metallurgical Results

Product	Weight %	Assays, %			% Distribution		
		Cu	Pb	Zn	Cu	Pb	Zn
1. Cu-Pb Cleaner Conc.	10.14	5.57	7.86	9.55	90.9	60.6	13.5
2. Cu-Pb 3rd Cl. Tail.	2.55	0.32	2.01	8.39	1.3	3.9	3.0
3. Cu-Pb 2nd Cl. Tail.	3.67	0.16	1.00	9.14	1.0	2.8	4.7
4. Cu-Pb 1st Cl. Tail.	11.16	0.099	0.86	9.32	1.8	7.3	14.5
5. Cu-Pb Rougher Tail.	72.48	0.043	0.46	6.34	5.0	25.4	64.3
Head (Calculated)	100.00	0.62	1.31	7.15	100.0	100.0	100.0

Calculated Grades and Recoveries

Products 1 and 2	12.69	4.52	6.68	9.32	92.2	64.5	16.5
Products 1 to 3	16.36	3.54	5.41	9.28	93.2	67.3	21.2
Products 1 to 4	27.52	2.14	3.56	9.29	95.0	74.6	35.7

Test No. 153

Purpose: To repeat test No. 149, but regrind the zinc rougher concentrate prior to cleaning.

Procedure: As for test No. 149, but regrind the zinc rougher concentrate.

Feed: 2000 grams minus 10 mesh Composite No. 2.

Grind: 25 minutes at 66 % solids in the laboratory ball mill.

Conditions:

Stage	Reagents Added, grams per tonne						Time, minutes			pH
	SO_2	$Ca(OH)_2$	R208	R317	MIBC	$CuSO_4$	Grind	Cond.	Froth	
Prim. Grind	-	-	-	-	-	-	25	-	-	-
Aeration	800	-	-	-	-	-	-	10	-	5.5
Condition	-	1200	-	-	-	-	-	3	-	8.8
Cu Rougher	-	-	10	5	15	-	-	2	3	-
	-	-	5	2.5	2.5	-	-	1	2	-
	-	-	5	-	2.5	-	-	1	1	-
Conc. Regr.	-	-	-	-	-	-	20	-	-	-
Condition	250	-	-	-	-	-	-	3	-	5.5
Cu 1st Cl.	-	-	2.5	-	2.5	-	-	2	3	-
	-	-	2.5	2.5	2.5	-	-	1	3	-
Cu 2nd Cl.	120	-	-	-	-	-	-	3	-	5.5
	-	-	2.5	-	-	-	-	1	3	-
	-	-	2.5	-	2.5	-	-	1	2	-
Cu 3rd Cl.	100	-	-	-	-	-	-	3	2	5.5
	-	-	2.5	-	2.5	-	-	1	2	-
Combine Cu rougher and 1st cleaner tailings for zinc flotation.										
Condition	-	1500	-	-	-	-	-	5	-	-
	-	-	-	-	-	450	-	5	-	11.6
Zn Rougher	-	-	10	10	5	-	-	1	3	-
	-	-	5	5	5	-	-	1	2	-
Conc. Regr.*	-	500	-	-	-	100	15	-	-	-
Zn 1st Cl.	-	-	2.5	-	2.5	-	-	1	2	11.8
	-	-	2.5	2.5	2.5	-	-	1	3	-
Zn 2nd Cl.	-	250	2.5	-	2.5	-	-	2	3	12.0
Zn 3rd Cl.	-	200	-	-	2.5	-	-	2	2	12.1

* Regrind in pebble mill

Test No. 153 - Continued

Metallurgical Results

Product	Weight %	Assays, %		% Distribution	
		Cu	Zn	Cu	Zn
1. Cu Cleaner Conc.	8.20	28.9	5.59	85.6	10.5
2. Cu 3rd Cl. Tail.	0.89	8.32	18.6	2.7	3.8
3. Cu 2nd Cl. Tail.	1.21	3.89	19.9	1.7	5.5
4. Zn Cleaner Conc.	5.63	2.00	50.1	4.1	64.9
5. Zn 3rd Cl. Tail.	0.80	3.15	23.3	0.9	4.3
6. Zn 2nd Cl. Tail.	1.92	2.20	12.8	1.5	5.7
7. Zn 1st Cl. Tail.	5.51	0.62	1.55	1.2	2.0
8. Zn Rougher Tail.	75.84	0.082	0.19	2.3	3.3
Head (Calculated)	100.00	2.77	4.35	100.0	100.0

Calculated Grades and Recoveries

Products 1 and 2	9.09	26.9	6.86	88.3	14.3
Products 1 to 3	10.30	24.2	8.40	90.0	19.8
Products 4 and 5	6.43	2.14	46.8	5.0	69.2
Products 4 to 6	8.35	2.16	39.0	6.5	74.9
Products 4 to 7	13.86	1.55	24.1	7.7	76.9
Products 4 to 8	89.70	0.31	3.88	10.0	80.2

Test No. 154

Purpose: To repeat test No. 153, but add depressant LS-3.

Procedure: As for test No. 153.

Feed: 2000 grams minus 10 mesh Composite No. 2.

Grind: 25 minutes at 66 % solids in the laboratory ball mill.

Conditions:

Stage	Reagents Added, grams per tonne							Time, minutes			pH
	LS-3	SO_2	$Ca(OH)_2$	R208	R317	MIBC	$CuSO_4$	Grind	Cond.	Froth	
Prim. Grind	150	-	-	-	-	-	-	25	-	-	-
Aeration	-	800	-	-	-	-	-	-	10	-	5.5
Condition	-	-	1200	-	-	-	-	-	3	-	8.8
Cu Rougher	-	-	-	10	5	15	-	-	2	3	-
	-	-	-	5	2.5	2.5	-	-	1	2	-
	-	-	-	5	2.5	2.5	-	-	1	2	-
Conc. Regr.	30	-	-	-	-	-	-	20	-	-	-
Condition	-	300	-	-	-	-	-	-	3	-	-
Cu 1st Cl.	-	-	-	2.5	-	2.5	-	-	2	3	5.5
	-	-	-	2.5	2.5	2.5	-	-	1	3	-
	-	-	-	-	2.5	2.5	-	-	1	1	-
Cu 2nd Cl.	20	120	-	-	-	-	-	-	3	-	5.5
	-	-	-	2.5	-	-	-	-	1	3	-
	-	-	-	2.5	2.5	2.5	-	-	1	2	-
Cu 3rd Cl.	15	100	-	-	-	-	-	-	3	2	5.5
	-	-	-	2.5	-	2.5	-	-	1	2	-
Combine Cu rougher and 1st cleaner tailings for zinc flotation.											
Condition	100	-	1500	-	-	-	-	-	5	-	-
	-	-	-	-	-	-	450	-	5	-	11.5
Zn Rougher	-	-	-	10	10	5	-	-	1	3	-
	-	-	-	5	5	5	-	-	1	2	-
Zn Conc. Regrind	30	-	500	-	-	-	100	15	-	-	-
Zn 1st Cl.	-	-	-	5	2.5	2.5	-	-	2	2	11.8
	-	-	-	5	2.5	-	-	-	1	3	-
Zn 2nd Cl.	20	-	300	-	-	-	-	-	2	2	11.9
	-	-	-	5	2.5	2.5	-	-	1	2	-
Zn 3rd Cl.	15	-	250	-	-	-	-	-	2	2	12.0
	-	-	-	5	-	2.5	-	-	1	1	-

Test No. 154 - Continued

Metallurgical Results

Product	Weight %	Assays, %		% Distribution	
		Cu	Zn	Cu	Zn
1. Cu Cleaner Conc.	6.68	31.4	2.69	76.8	3.8
2. Cu 3rd Cl. Tail.	0.80	16.2	5.40	4.7	0.9
3. Cu 2nd Cl. Tail.	1.39	7.22	7.27	3.7	2.1
4. Zn Cleaner Conc.	7.06	2.88	55.8	7.4	83.3
5. Zn 3rd Cl. Tail.	0.76	4.19	16.7	1.2	2.7
6. Zn 2nd Cl. Tail.	1.52	2.22	5.69	1.2	1.8
7. Zn 1st Cl. Tail.	4.33	0.80	1.69	1.3	1.5
8. Zn Rougher Tail.	77.46	0.13	0.24	3.7	3.9
Head (Calculated)	100.00	2.73	4.74	100.0	100.0

Calculated Grades and Recoveries

Products 1 and 2	7.48	29.8	2.98	81.5	4.7
Products 1 to 3	8.87	26.2	3.65	85.2	6.8
Products 4 and 5	7.82	3.01	52.0	8.6	86.0
Products 4 to 6	9.34	2.88	44.5	9.8	87.8
Products 4 to 7	13.67	2.22	30.9	11.1	89.3
Products 4 to 8	91.13	0.44	4.84	14.8	93.2

Test No. 155

Purpose: To repeat the conditions of test No. 142 but reduce regrinding time to 15 minutes and add zinc circuit.

Procedure: As indicated below.

Feed: 2000 grams minus 10 mesh Composite No. 2.

Grind: 25 minutes at 65 % solids in a laboratory ball mill.

Conditions:

Stage	Reagents Added, grams per tonne							Time, minutes			pH
	LS-3	SO_2	CaO	R208	R317	MIBC	$CuSO_4$	Grind	Cond.	Froth	
Grind	150	150	300	-	-	-	-	25	-	-	8.5
Aeration	-	500	-	-	-	-	-	-	10	-	-
Conditioning	-	-	-	-	-	-	-	-	3	-	6.5
Cu Rougher 1	-	-	-	10	5	10	-	-	1	3	-
Cu Rougher 2	-	-	-	5	2.5	5	-	-	1	2	-
Cu Rougher 3	-	-	-	5	2.5	2	-	-	1	1	-
Cu Regrind	30	250	-	-	-	-	-	15	-	-	-
Cu Cond.	-	-	100	-	-	-	-	-	3	-	6.5
Cu 1st Cl. 1	-	-	-	2.5	-	-	-	-	1	3	-
Cu 1st Cl. 2	-	-	-	2.5	2.5	2.5	-	-	1	2	-
Cu 2nd Cl. 1	20	100	-	-	-	-	-	-	3	-	6.5
Cu 2nd Cl. 2	-	-	50	-	-	-	-	-	1	3	-
	-	-	-	2.5	2.5	2.5	-	-	1	3	-
Cu 3rd Cl. 1	10	100	-	-	-	-	-	-	3	-	6.6
	-	-	50	-	-	-	-	-	1	3	-
	-	-	-	-	-	2.5	-	-	1	2	-
Zn Circuit											
Conditioning	-	-	1500	-	-	-	-	-	5	-	11.5
	-	-	-	-	-	-	450	-	5	-	-
Zn Rougher 1	-	-	-	5	5	5	-	-	1	3	-
Zn Rougher 2	-	-	-	5	5	5	-	-	1	2	-
Zn Conc. Regr.	-	-	300	-	-	-	100	10	-	-	-
Zn 1st Cl. 1	-	-	-	5	-	2.5	-	-	1	3	11.3
Zn 1st Cl. 2	-	-	-	-	-	-	-	-	1	2	-
Cu 2nd Cl. 1	-	-	220	-	-	-	-	-	3	3	11.2
Zn 2nd Cl. 2	-	-	-	-	-	2.5	-	-	1	2	-
Zn 3rd Cl.	-	-	200	-	-	-	-	-	3	2	11.5
	-	-	-	-	-	2.5	-	-	1	2	-

Test No. 155 - Continued

Metallurgical Results

Product	Weight	Assays, %		% Distribution		
	%	Cu	Zn	Cu	Zn	Zn Circuit
1. Cu Cleaner Conc.	8.64	28.5	4.21	92.2	8.8	-
2. Cu 3rd Cl. Tail.	0.51	6.84	8.09	1.3	1.0	-
3. Cu 2nd Cl. Tail.	1.57	2.27	13.4	1.3	5.1	-
4. Zn Cleaner Conc.	6.00	0.76	54.5	1.7	79.1	92.9
5. Zn 3rd Cl. Tail.	0.61	1.29	10.3	0.3	1.5	1.8
6. Zn 2nd Cl. Tail.	1.00	1.09	3.39	0.4	0.8	1.0
7. Zn 1st Cl. Tail.	5.53	0.42	0.82	0.9	1.1	1.3
8. Zn Rougher Tail.	76.14	0.067	0.14	1.9	2.6	3.0
Head (Calculated)	100.00	2.67	4.13	100.0	100.0	-

Calculated Grades and Recoveries

Products 1 and 2	9.15	27.29	4.43	93.5	9.8	-
Products 1 to 3	10.72	23.63	5.74	94.8	14.9	
Products 4 and 5	6.61	0.81	50.42	2.0	80.6	94.7
Products 4 to 6	7.61	0.85	44.24	2.4	81.4	95.7
Products 4 to 7	13.14	0.67	25.97	3.3	82.5	97.0
Products 4 to 8	89.28	0.16	3.94	5.2	85.1	100.0

Test No. 156

Purpose: To repeat the conditions of test No. 155 in order to study circuit reproducibility.

Procedure: Similar to test No. 155.

Feed: 2000 grams minus 10 mesh Composite No. 2.

Grind: 25 minutes at 65 % solids in a laboratory ball mill.

Conditions:

Stage	Reagents Added, grams per tonne							Time, minutes			pH
	LS-3	SO_2	CaO	R208	A317	MIBC	$CuSO_4$	Grind	Cond.	Froth	
Grind	150	150	300	-	-	-	-	25	-	-	-
Aeration	-	500	-	-	-	-	-	-	10	-	-
Conditioning	-	-	-	5	5	-	-	-	3	-	6.7
Cu Rougher 1	-	-	-	5	-	10	-	-	1	3	-
Cu Rougher 2	-	-	-	5	2.5	5	-	-	1	2	-
Cu Rougher 3	-	-	-	5	2.5	2	-	-	1	1	-
Regrind	30	250	-	-	-	-	-	15	-	-	-
Conditioning	-	-	100	-	-	-	-	-	3	-	-
Cu 1st Cl. 1	-	-	-	2.5	-	-	-	-	1	3	6.3
Cu 1st Cl. 2	-	-	-	2.5	2.5	2.5	-	-	1	2	-
Cu 2nd Cl. 1	20	100	-	-	-	-	-	-	3	-	6.5
Cu 2nd Cl. 2	-	-	50	-	-	-	-	-	1	3	-
Cu 3rd Cl.	-	-	-	2.5	2.5	2.5	-	-	1	3	-
	10	100	-	-	-	-	-	-	3	3	-
	-	-	-	-	-	2.5	-	-	1	2	-
Zinc Circuit											
Conditioning 1	-	-	1500	-	-	-	-	-	5	-	11.0
Conditioning 2	-	-	-	-	-	-	450	-	5	-	11.6
Zn Rougher 1	-	-	-	5	5	5	-	-	1	3	-
Zn Rougher 2	-	-	-	5	5	5	-	-	1	2	-
Zn Regrind	-	-	300	-	-	-	100	10	-	-	-
Zn 1st Cl. 1	-	-	-	-	-	-	-	-	1	3	11.3
Zn 1st Cl. 2	-	-	-	5	-	2.5	-	-	1	2	-
Zn 2nd Cl. 1	-	-	220	-	-	-	-	-	3	3	-
Zn 2nd Cl. 2	-	-	-	-	-	2.5	-	-	1	2	-
Zn 3rd Cl. 1	-	-	200	-	-	-	-	-	3	2	-
Zn 3rd Cl. 2	-	-	-	-	-	2.5	-	-	1	2	-

Test No. 156 - Continued

Metallurgical Results

Product	Weight	Assays, %		% Distribution		
	%	Cu	Zn	Cu	Zn	Zn Circuit
1. Cu Cleaner Conc.	9.06	28.0	4.45	92.2	9.3	-
2. Cu 3rd Cl. Tail.	0.57	6.45	9.46	1.3	1.2	-
3. Cu 2nd Cl. Tail.	1.75	2.34	14.5	1.5	5.9	-
4. Zn Cleaner Conc.	5.68	0.60	56.2	1.2	73.9	88.5
5. Zn 3rd Cl. Tail.	0.66	1.80	22.5	0.4	3.4	4.1
6. Zn 2nd Cl. Tail.	0.61	1.71	7.18	0.4	1.0	1.2
7. Zn 1st Cl. Tail.	3.50	0.67	1.92	0.9	1.6	1.9
8. Zn Rougher Tail.	78.17	0.073	0.20	2.1	3.7	4.3
Head (Calculated)	100.00	2.75	4.32	100.0	100.0	-

Calculated Grades and Recoveries

Products 1 and 2	9.63	26.72	4.75	93.5	10.5	-
Products 1 to 3	11.38	22.98	6.25	95.0	16.4	-
Products 4 and 5	6.34	0.73	52.69	1.6	77.3	92.6
Products 4 to 6	6.95	0.81	48.70	2.0	78.3	93.8
Products 4 to 7	10.45	0.76	33.03	2.9	79.9	95.7
Products 4 to 8	88.62	0.15	4.07	5.0	83.6	100.0

Test No. 157

Purpose:	To investigate the effect of different depressant combination on the flotation of Cu-Pb.
Procedure:	Grind and float a Cu-Pb rougher concentrate. Regrind the concentrate and clean three times. Filter the cleaner concentrate, repulp, condition and float copper.
Feed:	2000 grams minus 10 mesh Composite No. 3.
Grind:	35 minutes at 66 % solids in the laboratory ball mill.

Conditions:

Stage	Reagents Added, grams per tonne							Time, minutes			pH
	Na_2-CO_3	LS-3	Z-* Mix	SO_2	R208	R317	MIBC	Grind	Cond.	Froth	
Primary Grind	800	150	500	-	-	-	-	35	-	-	8.0
Condition	-	-	-	100	-	-	-	-	5	-	7.5
Cu-Pb Rougher	-	-	-	-	5	5	15	-	1	3	-
	-	-	-	-	5	5	5	-	1	3	-
	-	-	-	-	5	5	5	-	1	3	-
	-	-	-	-	5	5	5	-	1	3	-
Conc. Regr.	200	50	150	-	5	5	-	20	-	-	8.4
Condition	-	-	-	75	-	-	-	-	5	-	7.5
Cu-Pb 1st Cl.	-	-	-	-	-	-	5	-	1	3	-
	-	-	-	-	2.5	2.5	2.5	-	1	2	-
	-	-	-	-	2.5	2.5	2.5	-	1	2	-
Cond. Conc.	100	25	75	-	-	-	-	-	3	-	8.8
Cu-Pb 2nd Cl.	-	-	-	75	-	-	-	-	3	2	7.5
	-	-	-	-	2.5	2.5	2.5	-	1	3	-
Cond. Conc.	100	25	75	-	-	-	-	-	3	-	9.2
Cu-Pb 3rd Cl.	-	-	-	-	-	-	-	-	3	2	7.5
	-	-	-	-	5	-	2.5	-	1	2	-

* 40 % $ZnSO_4$, 40 % NaOH, 20 % NaCN

Stage	Rougher	Regrind	Cu-Pb Cleaners	Cu-Pb Separation
Flotation Cell	1000 g D - 1	Pebble Mill	500 g D - 1	500 g D - 1
Speed: r.p.m.	1800	-	1300	1300
% Solids	33	-	-	-

Test No. 157 - Continued

Conditions:

Stage	Reagents Added, grams per tonne				Time, minutes			pH
	A.C.	R-B	A325	MIBC	Grind	Cond.	Froth	
Cu-Pb Separation								
Filter Cu-Pb concentrate and repulp with fresh water.								
Condition	100	400	-	-	-	10	-	-
	-	150	-	-	-	5	-	-
Cu Flot.	-	-	-	5	-	1	3	-

Metallurgical Results

Product	Weight %	Assays, %			% Distribution		
		Cu	Pb	Zn	Cu	Pb	Zn
1. Cu Flotation Concentrate	4.17	11.0	8.99	4.99	78.3	30.4	2.9
2. Cu Flot. Tail.(Pb Conc.)	4.45	1.11	10.4	7.87	8.4	37.6	4.9
3. Cu-Pb 3rd Cl. Tail.	3.50	0.62	1.47	8.71	3.7	4.2	4.3
4. Cu-Pb 2nd Cl. Tail.	5.20	0.24	0.94	8.96	2.1	4.0	6.5
5. Cu-Pb 1st Cl. Tail.	12.97	0.085	0.60	9.44	1.9	6.3	17.1
6. Cu-Pb Rougher Tail.	69.71	0.047	0.31	6.59	5.6	17.5	64.3
Head (Calculated)	100.00	0.59	1.23	7.15	100.0	100.0	100.0

Calculated Grades and Recoveries

Products 1 and 2	8.62	5.89	9.72	6.48	86.7	68.0	7.8
Products 1 to 3	12.12	4.37	7.34	7.12	90.4	72.2	12.1
Products 1 to 4	17.32	3.13	5.42	7.67	92.5	76.2	18.6
Products 1 to 5	30.29	1.83	3.35	8.43	94.4	82.5	35.7

Test No. 158

Purpose: To investigate the effect of a different depressant combination on the flotation of Cu-Pb from Composite No. 4.

Procedure: Grind and float a Cu-Pb rougher concentrate. Regrind the concentrate and clean three times.

Feed: 2000 grams minus 10 mesh Composite No. 4.

Grind: 40 minutes at 66 % solids in the laboratory ball mill.

Conditions:

Stage	Reagents Added, grams per tonne								Time, minutes			pH
	Na_2-CO_3	LS-3	Z-Mix	SO_2	R208	R317	MIBC	R242	Grind	Cond.	Froth	
Primary Grind	800	150	500	-	-	-	-	-	40	-	-	7.8
Condition	-	-	-	100	-	-	-	-	-	5	-	7.5
Cu-Pb Rougher	-	-	-	-	10	10	15	-	-	1	3	-
	-	-	-	-	5	5	5	-	-	1	3	-
	-	-	-	-	5	5	2.5	-	-	1	2	-
	-	-	-	-	5	5	2.5	-	-	1	2	-
Conc. Regr.	200	50	150	-	-	5	-	5	20	-	-	-
Condition	-	-	-	50	-	-	-	-	-	5	-	7.7
Cu-Pb 1st Cl.	-	-	-	-	-	-	2.5	-	-	1	3	7.5
	-	-	-	-	-	2.5	-	2.5	-	1	2	-
	-	-	-	-	-	2.5	-	2.5	-	1	2	-
Condition Conc.	100	25	75	-	-	-	-	-	-	3	-	8.3
Cu-Pb 2nd Cl.	-	-	-	75	-	-	-	-	-	3	2	7.5
	-	-	-	-	-	2.5	-	2.5	-	1	3	-
Condition Conc.	100	25	75	-	-	-	-	-	-	3	-	8.6
Cu-Pb 3rd Cl.	-	-	-	75	-	-	-	-	-	3	2	7.5
	-	-	-	-	-	-	-	2.5	-	1	2	-

Test No. 158 - Continued

Metallurgical Results

Product	Weight	Assays, %			% Distribution		
	%	Cu	Pb	Zn	Cu	Pb	Zn
1. Cu-Pb Cleaner Conc.	7.98	2.00	20.9	7.63	47.1	50.5	7.1
2. Cu-Pb 3rd Cl. Tail.	4.80	1.76	7.91	8.47	24.9	11.5	4.8
3. Cu-Pb 2nd Cl. Tail.	6.09	0.47	4.31	9.18	8.4	8.0	6.5
4. Cu-Pb 1st Cl. Tail.	10.48	0.17	3.25	9.82	5.2	10.3	12.0
5. Cu-Pb Rougher Tail.	70.65	0.069	0.92	8.42	14.4	19.7	69.6
Head (Calculated)	100.00	0.34	3.30	8.55	100.0	100.0	100.0

Calculated Grades and Recoveries

Products 1 and 2	12.78	1.91	16.0	7.95	72.0	62.0	11.9
Products 1 to 3	18.87	1.45	12.24	8.34	80.4	70.0	18.4
Products 1 to 4	29.35	0.99	9.03	8.87	85.6	80.3	30.4

Test No. 159

Purpose: To repeat test No. 156, but omit depressant LS-3.

Procedure: As for test No. 155.

Feed: 2000 grams minus 10 mesh Composite No. 2.

Grind: 25 minutes at 65 % solids in the laboratory ball mill.

Conditions:

Stage	Reagents Added, grams per tonne						Time, minutes			pH
	$Ca(OH)_2$	SO_2	R208	A317	MIBC	$CuSO_4$	Grind	Cond.	Froth	
Prim. Grind	300	150	-	-	-	-	25	-	-	-
Aeration	-	500	-	-	-	-	-	10	-	-
Condition	-	-	5	5	-	-	-	3	-	6.7-7.2
Cu Rougher	-	-	5	-	10	-	-	1	3	-
	-	-	5	2.5	5	-	-	1	2	-
	-	-	5	2.5	2	-	-	1	1	-
Conc. Regr.	-	250	-	-	-	-	15	-	-	-
Condition	100	-	-	-	-	-	-	3	-	6.3
Cu 1st Cl.	-	-	2.5	-	2.5	-	-	1	3	-
	-	-	2.5	2.5	2.5	-	-	1	2	-
	-	-	-	2.5	2.5	-	-	1	1	-
Cu 2nd Cl.	-	100	-	-	-	-	-	3	-	5.5
	50	-	-	-	-	-	-	1	3	6.5
	-	-	2.5	2.5	2.5	-	-	1	2	-
Cu 3rd Cl.	-	100	-	-	-	-	-	3	3	6.2
	-	-	2.5	-	2.5	-	-	1	2	-
Combine Cu rougher and 1st cleaner tailings for zinc flotation.										
Condition	1500	-	-	-	-	-	-	5	-	-
	-	-	-	-	-	450	-	5	-	11.3
Zn Rougher	-	-	5	5	5	-	-	1	3	-
	-	-	5	5	5	-	-	1	2	-
Conc. Regr.	300	-	-	-	-	100	10	-	-	-
Zn 1st Cl.	-	-	-	-	-	-	-	1	3	11.4
	-	-	5	-	2.5	-	-	1	2	-
Zn 2nd Cl.	250	-	-	-	-	-	-	2	3	11.7
	-	-	2.5	-	2.5	-	-	1	2	-
Zn 3rd Cl.	200	-	-	-	-	-	-	2	2	11.8
	-	-	-	-	2.5	-	-	1	2	-

Test No. 159 - Continued

Metallurgical Results

Product	Weight %	Assays, %		% Distribution	
		Cu	Zn	Cu	Zn
1. Cu Cleaner Conc.	10.87	23.4	9.35	92.6	25.0
3. Cu 3rd Cl. Tail.	0.58	3.15	8.65	0.7	1.2
3. Cu 2nd Cl. Tail.	1.35	2.01	8.91	1.0	3.0
4. Zn Cleaner Conc.	5.79	1.01	46.4	2.1	66.2
5. Zn 3rd Cl. Tail.	0.26	1.32	6.22	0.1	0.4
6. Zn 2nd Cl. Tail.	1.18	0.86	2.76	0.4	0.8
7. Zn 1st Cl. Tail.	5.46	0.30	0.62	0.6	0.8
8. Zn Rougher Tail.	74.51	0.094	0.14	2.5	2.6
Head (Calculated)	100.00	2.75	4.06	100.0	100.0

Calculated Grades and Recoveries

Products 1 and 2	11.45	22.4	9.31	93.3	26.2
Products 1 to 3	12.80	20.2	9.27	94.3	29.2
Products 4 and 5	6.05	1.02	44.7	2.2	66.6
Products 4 to 6	7.23	1.00	37.8	2.6	67.4
Products 4 to 7	12.69	0.70	21.8	3.2	68.2
Products 4 to 8	87.20	0.18	3.30	5.7	70.8

Test No. 160

Purpose: To repeat test No. 159 to investigate the reproducibility.

Procedure: As for test No. 155.

Feed: 2000 grams minus 10 mesh Composite No. 2.

Grind: 25 minutes at 65 % solids in the laboratory ball mill.

Conditions:

Stage	Reagents Added, grams per tonne						Time, minutes			pH
	$Ca(OH)_2$	SO_2	R208	A317	MIBC	$CuSO_4$	Grind	Cond.	Froth	
Primary Grind	300	150	-	-	-	-	25	-	-	-
Aeration	-	500	-	-	-	-	-	10	-	6.6-7.1
Condition	-	-	5	5	-	-	-	3	-	-
Cu Rougher	-	-	5	-	10	-	-	1	3	-
	-	-	5	2.5	5	-	-	1	2	-
	-	-	5	2.5	2	-	-	1	1	-
Cu Conc. Regr.	-	250	-	-	-	-	15	-	-	-
Condition	100	-	-	-	-	-	-	3	-	6.2
Cu 1st Cl.	-	-	2.5	-	2.5	-	-	1	3	-
	-	-	2.5	2.5	2.5	-	-	1	2	-
	-	-	-	2.5	2.5	-	-	1	1	-
Cu 2nd Cl.	-	100	-	-	-	-	-	3	-	5.6
	50	-	-	-	-	-	-	1	3	6.5
	-	-	2.5	2.5	2.5	-	-	1	2	-
Cu 3rd Cl.	-	100	-	-	-	-	-	3	3	6.2
	-	-	2.5	-	2.5	-	-	1	2	-
Combine Cu rougher and 1st cleaner tailings for zinc flotation.										
Condition	1500	-	-	-	-	-	-	5	-	-
	-	-	-	-	-	450	-	5	-	11.2
Zn Rougher	-	-	5	5	5	-	-	1	3	-
	-	-	5	5	5	-	-	1	2	-
Conc. Regrind	300	-	-	-	-	100	10	-	-	-
Zn 1st Cl.	-	-	-	-	-	-	-	1	3	11.5
	-	-	5	-	2.5	-	-	1	2	-
Zn 2nd Cl.	250	-	-	-	-	-	-	2	3	11.7
	-	-	2.5	-	2.5	-	-	1	2	-
Zn 3rd Cl.	200	-	-	-	-	-	-	2	2	11.8
	-	-	-	-	2.5	-	-	1	2	-

Test No. 160 - Continued

Metallurgical Results

Product	Weight %	Assays, %		% Distribution	
		Cu	Zn	Cu	Zn
1. Cu Cleaner Conc.	10.91	23.3	7.10	92.9	18.5
2. Cu 3rd Cl. Tail.	0.67	3.04	11.4	0.7	1.8
3. Cu 2nd Cl. Tail.	2.21	1.56	10.9	1.3	5.8
4. Zn Cleaner Conc.	5.77	0.85	50.0	1.8	69.0
5. Zn 3rd Cl. Tail.	0.32	1.25	7.22	0.1	0.6
6. Zn 2nd Cl. Tail.	1.24	0.78	3.07	0.4	0.9
7. Zn 1st Cl. Tail.	6.00	0.31	0.66	0.7	0.9
8. Zn Rougher Tail.	72.88	0.078	0.14	2.1	2.5
Head (Calculated)	100.00	2.74	4.18	100.0	100.0

Calculated Grades and Recoveries

Products 1 and 2	11.58	22.1	7.35	93.6	20.3
Products 1 to 3	13.79	18.8	7.92	94.9	26.1
Products 4 and 5	6.09	0.87	47.8	1.9	69.6
Products 4 to 6	7.33	0.86	40.2	2.3	70.5
Products 4 to 7	13.33	0.61	22.4	3.0	71.4
Products 4 to 8	86.21	0.16	3.58	5.1	73.9

Test No. 161

Purpose: To repeat test No. 158, but substitute R241 for R208 in the Cu-Pb rougher.

Procedure: As for test No. 158.

Feed: 2000 grams minus 10 mesh Composite No. 4.

Grind: 40 minutes at 66 % solids in the laboratory ball mill.

Conditions:

Stage	Reagents Added, grams per tonne							Time, minutes			pH
	Na_2-CO_3	LS-3	Z-Mix	SO_2	R241	R317	MIBC	Grind	Cond.	Froth	
Primary Grind	1000	150	500	-	-	-	-	40	-	-	-
Condition	-	-		100	-	-	-	-	5	-	7.5
Cu-Pb Rougher	-	-	-	-	10	10	10	-	1	3	-
	-	-		-	10	10	-	-	1	3	-
	-	-	-	-	5	5	-	-	1	2	-
	-	-	-	-	5	5	-	-	1	2	-
Conc. Regrind	250	50	150	-	5	5	-	20	-	-	-
Condition	-	-	-	50	2.5	2.5	-	-	5	3	7.2
Cu-Pb 1st Cl.	-	-	-	-	2.5	2.5	-	-	1	2	-
	-	-	-	-	2.5	2.5	-	-	1	2	-
Cond. Conc.	100	25	75	-	-	-	-	-	3	-	8.2
Cu-Pb 2nd Cl.	-	-	-	75	-	-	-	-	3	2	7.5
	-	-	-	-	2.5	2.5	-	-	1	3	-
Cond. Conc.	100	25	75	-	-	-	-	-	3	-	8.3
Cu-Pb 3rd Cl.	-	-	-	75	-	-	-	-	3	2	7.5
	-	-	-	-	2.5	-	-	-	1	2	-

Test No. 161 - Continued

Metallurgical Results

Product	Weight	Assays, %			% Distribution		
	%	Cu	Pb	Zn	Cu	Pb	Zn
1. Cu-Pb Cleaner Conc.	10.49	2.00	18.1	7.35	60.5	56.9	9.0
2. Cu-Pb 3rd Cl. Tail.	4.66	0.88	6.86	9.31	11.8	9.6	5.1
3. Cu-Pb 2nd Cl. Tail.	5.50	0.41	3.92	9.72	6.5	6.5	6.2
4. Cu-Pb 1st Cl. Tail.	9.18	0.15	2.35	9.91	4.0	6.5	10.6
5. Cu-Pb Rougher Tail.	70.17	0.085	0.98	8.45	17.2	20.5	69.1
Head (Calculated)	100.00	0.35	3.34	8.58	100.0	100.0	100.0

Calculated Grades and Recoveries

Products 1 and 2	15.15	1.66	14.6	7.95	72.3	66.5	14.1
Products 1 to 3	20.65	1.32	11.8	8.42	78.8	73.0	20.3
Products 1 to 4	29.83	0.96	8.88	8.88	82.8	79.5	30.9

Test No. 162

Purpose: To attempt to produce a higher grade Cu-Pb cleaner concentrate.

Procedure: Grind, aerate and float a Cu-Pb rougher concentrate. Regrind the concentrate and clean three times.

Feed: 2000 grams minus 10 mesh Composite No. 3.

Grind: 30 minutes at 66 % solids in the laboratory ball mill.

Conditions:

Stage	Reagents Added, grams per tonne						Time, minutes			pH
	Na_2CO_3	SO_2	R208	A317	MIBC	$Ca(OH)_2$	Grind	Cond.	Froth	
Primary Grind	500	125	-	-	-	-	30	-	-	7.8
Aeration	-	250	-	-	-	-	-	10	-	7.0
Cu-Pb Rougher	-	-	10	10	10	-	-	1	3	-
Condition	-	-	-	-	-	200	-	2	-	8.0
Cu-Pb Ro.(Contd)	-	-	10	10	5	-	-	1	3	-
	-	-	5	5	2.5	-	-	1	3	-
Filter Cu-Pb concentrate for regrinding										
Conc. Regr.*	200	250	-	2.5	-	-	15	-	-	6.5
Condition	-	-	-	-	-	200	-	1	-	8.5
Cu-Pb 1st Cl.	-	-	2.5	-	7.5	-	-	1	3	-
	-	-	-	10	-	-	-	1	3	-
Cond. Conc.	-	-	-	-	-	150	-	2	-	10.0
Cu-Pb 2nd Cl.	-	-	-	-	2.5	-	-	1	3	-
	-	-	5	5	-	-	-	1	2	-
Cu-Pb 3rd Cl.	-	-	-	-	-	150	-	-	-	10.2
	-	-	-	-	5	-	-	1	2	-
	-	-	5	5	-	-	-	1	2	-

* Pebble Mill

Test No. 162 - Continued

Metallurgical Results

Product	Weight %	Assays, %			% Distribution		
		Cu	Pb	Zn	Cu	Pb	Zn
1. Cu-Pb Cleaner Conc.	7.31	7.29	9.59	7.07	89.2	56.3	7.5
2. Cu-Pb 3rd Cl. Tail.	2.18	0.43	2.62	6.77	1.6	4.6	2.1
3. Cu-Pb 2nd Cl. Tail.	5.28	0.20	1.47	7.87	1.8	6.2	6.0
4. Cu-Pb 1st Cl. Tail.	11.94	0.12	0.98	9.98	2.4	9.4	17.2
5. Cu-Pb Rougher Tail.	73.29	0.041	0.40	6.36	5.0	23.5	67.2
Head (Calculated)	100.00	0.60	1.25	6.93	100.0	100.0	100.0

Calculated Grades and Recoveries

Products 1 and 2	9.49	5.71	7.99	7.00	90.8	60.9	9.6
Products 1 to 3	14.77	3.74	5.66	7.31	92.6	67.1	15.6
Products 1 to 4	26.71	2.12	3.57	8.50	95.0	76.5	32.8

Test No. 163

Purpose: To repeat test No. 162, but add depressant LS-3, and float rougher at a higher pH.

Procedure: As for test No. 162.

Feed: 2000 grams minus 10 mesh Composite No. 3.

Grind: 30 minutes at 66 % solids in the laboratory ball mill.

Conditions:

Stage	Reagents Added, grams per tonne							Time, minutes			pH
	Na_2CO_3	SO_2	LS-3	R208	A317	MIBC	$Ca(OH)_2$	Grind	Cond.	Froth	
Primary Grind	500	125	200	-	-	-	-	30	-	-	8.0
Aeration 1	-	250	-	-	-	-	-	-	5	-	7.3
Aeration 2	-	-	-	-	-	-	1000	-	5	-	10.0
Cu-Pb Rougher	-	-	-	20	20	10	-	-	1	4	-
	-	-	-	10	10	5	-	-	1	3	-
Filter Cu-Pb concentrate for regrinding.											
Conc. Regrind	200	250	30	-	2.5	-	-	10	-	-	7.2
Condition	-	-	-	-	-	-	250	-	2	-	9.2
Cu-Pb 1st Cl.	-	-	-	2.5	-	5	-	-	1	3	-
	-	-	-	-	5	2.5	-	-	1	3	-
Cu-Pb 2nd Cl.	-	-	-	-	-	-	50	-	1	-	9.7
	-	-	-	5	5	-	-	-	1	3	-
	-	-	-	2.5	2.5	-	-	-	1	2	-
Cu-Pb 3rd Cl.	-	-	-	-	-	-	50	-	-	-	9.6
	-	-	-	2.5	5	-	-	-	1	4	-

Test No. 163 - Continued

Metallurgical Results

Product	Weight %	Assays, %			% Distribution		
		Cu	Pb	Zn	Cu	Pb	Zn
1. Cu-Pb Cleaner Conc.	6.56	7.92	10.8	8.41	86.1	60.7	7.8
2. Cu-Pb 3rd Cl. Tail.	0.64	0.77	4.41	10.8	0.8	2.4	1.0
3. Cu-Pb 2nd Cl. Tail.	1.87	0.49	3.00	12.0	1.5	4.8	3.2
4. Cu-Pb 1st Cl. Tail.	7.57	0.28	1.32	15.9	3.5	8.6	17.0
5. Cu-Pb Rougher Tail.	83.36	0.058	0.33	6.06	8.1	23.5	71.0
Head (Calculated)	100.00	0.60	1.17	7.10	100.0	100.0	100.0

Calculated Grades and Recoveries

Products 1 and 2	7.20	7.28	10.23	8.62	86.9	63.1	8.8
Products 1 to 3	9.07	5.88	8.74	9.32	88.4	67.9	12.0
Products 1 to 4	16.64	3.33	5.36	12.31	91.9	76.5	29.0

Test No. 164

Purpose: To repeat test No. 163, but omit depressant LS-3.

Procedure: As for test No. 162.

Feed: 2000 grams minus 10 mesh Composite No. 3.

Grind: 30 minutes at 66 % solids in the laboratory ball mill.

Conditions:

Stage	Reagents Added, grams per tonne						Time, minutes			pH
	Na_2CO_3	SO_2	$Ca(OH)_2$	R208	A317	MIBC	Grind	Cond.	Froth	
Primary Grind	500	125	-	-	-	-	30	-	-	8.0
Aeration 1	-	250	-	-	-	-	-	5	-	7.3
Aeration 2	-	-	1000	-	-	-	-	5	-	10.0
Cu-Pb Rougher	-	-	-	20	20	10	-	1	4	-
	-	-	-	10	10	5	-	1	3	-
Filter Cu-Pb concentrate for regrinding										
Conc. Regrind	200	250	-	-	2.5	-	15	-	-	-
Condition	-	-	250	-	-	-	-	2	-	9.4
Cu-Pb 1st Cl.	-	-	-	2.5	-	5	-	1	3	-
	-	-	-	-	5	2.5	-	1	3	-
Cu-Pb 2nd Cl.	-	-	50	-	-	-	-	1	-	9.6
	-	-	-	5	5	-	-	1	3	-
	-	-	-	2.5	2.5	2.5	-	1	2	-
Cu-Pb 3rd Cl.	-	-	50	-	-	-	-	1	-	9.7
	-	-	-	2.5	5	2.5	-	1	4	-

Test No. 164 - Continued

Metallurgical Results

Product	Weight %	Assays, %			% Distribution		
		Cu	Pb	Zn	Cu	Pb	Zn
1. Cu-Pb Cleaner Conc.	10.03	5.61	8.48	8.92	90.6	65.1	12.5
2. Cu-Pb 3rd Cl. Tail.	0.53	0.31	1.83	6.53	0.3	0.7	0.5
3. Cu-Pb 2nd Cl. Tail.	2.48	0.24	1.30	11.5	0.9	2.5	4.0
4. Cu-Pb 1st Cl. Tail.	10.00	0.14	0.83	12.8	2.3	6.4	17.9
5. Cu-Pb Rougher Tail.	76.97	0.048	0.43	6.04	5.9	25.3	65.1
Head (Calculated)	100.00	0.62	1.31	7.14	100.0	100.0	100.0

Calculated Grades and Recoveries

Products 1 and 2	10.56	5.34	8.15	8.80	90.9	65.8	13.0
Products 1 to 3	13.03	4.38	6.85	9.31	91.8	68.3	17.0
Products 1 to 4	23.03	2.54	4.24	10.83	94.1	74.7	34.9

Test No. 165

Purpose: To repeat test No. 149, to investigate the reproducibility.

Procedure: As for test No. 149.

Feed: 2000 grams minus 10 mesh Composite No. 2.

Grind: 25 minutes at 66 % solids in the laboratory ball mill.

Conditions:

Stage	Reagents Added, grams per tonne						Time, minutes			pH
	SO_2	$Ca(OH)_2$	R208	R317	MIBC	$CuSO_4$	Grind	Cond.	Froth	
Prim. Grind	-	-	-	-	-	-	25	-	-	-
Aeration	800	-	-	-	-	-	-	10	-	5.5
Condition	-	1200	-	-	-	-	-	3	-	9.5
Cu Rougher	-	-	10	5	15	-	-	2	3	-
	-	-	5	2.5	2.5	-	-	1	2	-
	-	-	5	-	2.5	-	-	1	1	-
Conc. Regr.	-	-	-	-	-	-	20	-	-	-
Condition	250	-	-	-	-	-	-	3	-	5.5
Cu 1st Cl.	-	-	2.5	-	2.5	-	-	2	3	-
	-	-	2.5	2.5	2.5	-	-	1	3	-
Cu 2nd Cl.	120	-	-	-	-	-	-	3	-	5.5
	-	-	2.5	-	-	-	-	1	3	-
	-	-	2.5	-	2.5	-	-	1	2	-
Cu 3rd Cl.	100	-	-	-	-	-	-	3	2	5.5
	-	-	2.5	-	2.5	-	-	1	2	-
Combine Cu rougher and 1st cleaner tailings for zinc flotation.										
Condition	-	1500	-	-	-	-	-	-	-	-
	-	-	-	-	-	450	-	-	-	11.5
Zn Rougher	-	-	10	5	5	-	-	1	3	-
	-	-	5	5	5	-	-	1	2	-
Zn 1st Cl.	-	250	-	-	-	-	-	1	2	11.8
	-	-	2.5	-	2.5	-	-	1	2	-
Zn 2nd Cl.	-	200	-	-	2.5	-	-	2	3	12.0
Zn 3rd Cl.	-	200	-	-	2.5	-	-	2	2	12.0

Test No. 165 - Continued

Metallurgical Results

Product	Weight	Assays, %		% Distribution		
	%	Cu	Zn	Cu	Zn	Zn Circuit
1. Cu Cleaner Conc.	10.09	24.5	4.79	90.4	11.5	-
2. Cu 3rd Cl. Tail.	1.66	3.72	11.7	2.3	4.6	-
3. Cu 2nd Cl. Tail.	2.84	1.15	8.40	1.2	5.7	-
4. Zn Cleaner Conc.	5.83	0.65	51.3	1.4	71.5	91.4
5. Zn 3rd Cl. Tail.	0.57	2.35	15.4	0.5	2.1	2.7
6. Zn 2nd Cl. Tail.	0.85	1.77	3.75	0.5	0.8	1.0
7. Zn 1st Cl. Tail.	4.62	0.63	0.94	1.1	1.0	1.3
8. Zn Rougher Tail.	73.54	0.10	0.16	2.6	2.8	3.6
Head (Calculated)	100.00	2.74	4.19	100.0	100.0	-

Calculated Grades and Recoveries

Products 1 and 2	11.75	21.56	5.77	92.7	16.1	-
Products 1 to 3	14.59	17.60	6.28	93.9	21.8	-
Products 4 and 5	6.40	0.80	48.1	1.9	73.6	94.1
Products 4 to 6	7.25	0.91	42.9	2.4	74.4	95.1
Products 4 to 7	11.87	0.80	26.57	3.5	75.4	96.4
Products 4 to 8	85.41	0.20	3.83	6.1	78.2	100.0

Test No. 166

Purpose: To repeat the conditions of test No. 163 but replace Na_2CO_3 additions to the grind with CaO additions.

Procedure: Similar to test No. 163, but add zinc circuit.

Feed: 2000 grams minus 10 mesh Composite No. 3.

Grind: 30 minutes at 65 % solids in a laboratory ball mill.

Conditions:

Stage	Reagents Added, grams per tonne								Time, minutes			pH
	CaO	SO_2	LS-3	R317	R208	MIBC	R-B	A.C.	Grind	Cond.	Froth	
Grind	500	250	200	-	-	-	-	-	30	-	-	-
Aeration	200	200	-	-	-	-	-	-	-	5	-	10.0
Cu-Pb Ro. 1	-	-	-	20	20	10	-	-	-	1	4	-
Cu-Pb Ro. 2	-	-	-	10	10	5	-	-	-	1	3	-
Cu-Pb Ro. Conc. Regrind	200	250	30	5	-	-	-	-	10	-	-	-
Conditioning	100	-	-	5	-	-	-	-	-	3	-	9.5
Cu-Pb 1st Cl. 1	-	-	-	2	2	5	-	-	-	1	3	-
Cu-Pb 1st Cl. 2	-	-	-	5	-	2.5	-	-	-	1	3	-
Cu-Pb 2nd Cl.	100	-	10	-	-	-	-	-	-	2	3	-
	-	-	-	5	5	-	-	-	-	1	3	-
Cu-Pb 3rd Cl.	100	-	10	-	-	-	-	-	-	2	3	-
	-	-	-	2.5	5	-	-	-	-	1	3	-
Cu-Pb Separation												
Conditioning	-	-	-	-	-	-	250	100	-	10	-	-
	-	-	-	-	-	-	100	-	-	10	-	-
Cu Rougher	-	-	-	-	5	5	-	-	-	1	4	-
Conditioning	-	-	-	-	-	-	100	50	-	10	-	-
Cu Cleaner	-	-	-	-	-	5	-	-	-	1	4	-

Test No. 166 - Continued

Conditions:

Stage	Reagents Added, grams per tonne				Time, minutes			pH
	CaO	$CuSO_4$	A350	MIBC	Grind	Cond.	Froth	
Zinc Circuit (Cu-Pb rougher + 1st cleaner tailings)								
Conditioning 1	1200	-	-	-	-	5	-	-
Conditioning 2	-	500	-	-	-	5	-	-
Zn Rougher 1	-	-	20	10	-	1	3	-
Zn Rougher 2	-	-	5	5	-	1	4	-
Zn Regrind	600	50	-	-	10	-	-	11.8
Zn 1st Cl. 1	-	-	2.5	-	-	1	3	-
Zn 1st Cl. 2	-	-	-	2.5	-	1	2	-
Cu 2nd Cl. 1	200	-	-	-	-	2	3	11.6
Cu 2nd Cl. 2	-	-	-	2.5	-	1	3	-
Cu 3rd Cl. 1	200	-	-	-	-	2	3	-
Cu 3rd Cl. 2	-	-	-	-	-	1	3	-

Test No. 166 - Continued

Metallurgical Results

Product	Weight	Assays, %, g/t				% Distribution			
	%	Cu	Pb	Zn	Ag	Cu	Pb	Zn	Ag
1. Cu Cleaner Conc.	1.88	19.8	5.25	5.83	6002.	64.5	8.3	1.6	47.5
2. Cu Cleaner Tail.	0.44	2.97	19.9	6.01	1773.	2.2	7.4	0.4	3.3
3. Cu-Pb Sep'n Tail.	2.17	1.26	17.5	6.69	729.	4.7	32.0	2.2	6.6
4. Cu-Pb 3rd Cl. Tail.	0.62	2.33	4.58	7.31	828.	2.5	2.4	0.7	2.2
5. Cu-Pb 2nd Cl. Tail.	2.50	1.18	3.01	8.36	520.	5.1	6.4	3.1	5.5
6. Zn Cleaner Conc.	10.79	0.29	0.59	49.8	177.	5.4	5.4	80.1	8.0
7. Zn 3rd Cl. Tail.	1.28	0.55	2.01	19.4	333.	1.2	2.2	3.7	1.8
8. Zn 2nd Cl. Tail.	1.32	0.64	2.26	7.45	299.	1.5	2.5	1.5	1.7
9. Zn 1st Cl. Tail.	7.27	0.33	1.10	2.58	162.	4.2	6.8	2.8	5.0
10. Zn Rougher Tail.	71.74	0.07	0.44	0.37	61.2	8.7	26.6	4.0	18.4
Head (Calculated)	100.00	0.58	1.18	6.71	237.5	100.0	100.0	100.0	100.0

Calculated Grades and Recoveries

Products 1 and 2	2.32	16.61	8.03	5.86	5200.	66.7	15.7	2.0	50.8
Products 1 to 3	4.48	9.21	12.60	6.26	3044.	71.4	47.7	4.2	57.4
Products 2 and 3	2.60	1.55	17.91	6.57	906.	6.9	39.4	2.6	9.9
Products 1 to 4	5.10	8.37	11.62	6.39	2775.	73.9	50.1	4.9	59.6
Products 1 to 5	7.60	6.01	8.79	7.04	2033.	79.0	56.5	8.0	65.1
Products 6 and 7	12.07	0.32	0.74	46.58	194.	6.6	7.6	83.8	9.8
Products 6 to 8	13.39	0.35	0.89	42.72	204.	8.1	10.1	85.3	11.5
Products 6 to 9	20.66	0.34	0.96	28.59	189.	12.3	16.9	88.0	16.5
Products 6 to 10	92.40	0.13	0.56	6.68	89.8	21.0	43.5	92.1	34.9

Test No. 167

Purpose: To repeat test No. 166, but omit depressant LS-3.

Procedure: As for test No. 166.

Feed: 2000 grams minus 10 mesh Composite No. 3.

Grind: 30 minutes at 65 % solids in the laboratory ball mill.

Conditions:

Stage	Reagents Added, grams per tonne								Time, minute			pH
	Ca-(OH)$_2$	SO$_2$	R317	R208	MIBC	Reag. B	A.C.	A325	Grind	Cond.	Froth	
Primary Grind	500	250	-	-	-	-	-	-	30	-	-	-
Aeration	200	200	-	-	-	-	-	-	-	5	-	10.0
Cu-Pb Rougher	-	-	20	20	10	-	-	-	-	1	4	-
	-	-	10	10	5	-	-	-	-	1	3	-
Cu-Pb Conc. Regr.	200	250	5	-	-	-	-	-	10	-	-	-
Condition	100	-	5	-	-	-	-	-	-	3	-	9.5
Cu-Pb 1st Cl.	-	-	2.5	2	5	-	-	-	-	1	3	-
	-	-	5	-	2.5	-	-	-	-	1	3	-
Cu-Pb 2nd Cl.	100	-	-	-	2.5	-	-	-	-	2	2	10.1
	-	-	5	5	2.5	-	-	-	-	1	3	-
Cu-Pb 3rd Cl.	100	-	-	-	-	-	-	-	-	2	2	10.5
	-	-	2.5	5	-	-	-	-	-	1	2	-
Cu-Pb Separation												
Condition	-	-	-	-	-	250	150	-	-	10	-	-
	-	-	-	-	-	100	-	-	-	10	-	-
Cu Rougher	-	-	-	-	4	-	-	-	-	1	3	-
	-	-	-	-	4	-	-	2	-	1	3	-
Cond. Cu Conc.	-	-	-	-	-	200	100	-	-	10	-	-
Cu Cleaner A	-	-	-	-	4	-	-	-	-	1	2	-
Cu Cleaner B	-	-	-	-	2	-	-	1	-	1	2	-

Test No. 167 - Continued

Conditions:

Stage	Reagents Added, g/tonne				Time, minutes			pH
	$Ca(OH)_2$	$CuSO_4$	A350	MIBC	Grind	Cond.	Froth	
Zinc Circuit (Cu-Pb rougher + 1st cleaner tailings)								
Condition	1200	-	-	-	-	5	-	-
	-	500	-	-	-	5	-	10.8
Zn Rougher	-	-	20	10	-	1	3	-
	-	-	5	5	-	1	4	-
Zn Conc. Regr.	600	50	-	-	-	10	-	-
Zn 1st Cl.	-	-	2.5	-	-	1	3	11.4
	-	-	-	2.5	-	1	3	-
Zn 2nd Cl.	200	-	-	-	-	2	3	11.6
	-	-	-	2.5	-	1	2	-
Zn 3rd Cl.	200	-	-	2.5	-	2	4	11.7

Test No. 167 - Continued

Metallurgical Results

Product	Weight %	Assays, %, g/t				% Distribution			
		Cu	Pb	Zn	Ag	Cu	Pb	Zn	Ag
1. Cu Cleaner Conc. A	2.10	21.1	1.19	9.75	3163.	74.5	2.1	3.0	27.4
2. Cu Cleaner Conc. B	0.45	4.20	3.52	15.3	2421.	3.2	1.3	1.0	4.5
3. Cu Cleaner Tailing	0.18	0.73	8.77	2.68	4377.	0.2	1.3	0.1	3.3
4. Cu-Pb Sep'n Tail.	4.55	0.52	14.6	4.82	1426.	4.0	56.1	3.2	26.8
5. Cu-Pb 3rd Cl. Tail.	1.46	0.67	1.76	6.51	458.	1.6	2.2	1.4	2.8
6. Cu-Pb 2nd Cl. Tail.	3.34	0.34	1.13	7.42	319.	1.9	3.2	3.6	4.4
7. Zn Cleaner Conc.	8.62	0.24	0.45	51.5	149.	3.5	3.3	64.6	5.3
8. Zn 3rd Cl. Tail.	1.78	0.23	0.75	23.7	191.	0.7	1.1	6.1	1.4
9. Zn 2nd Cl. Tail.	3.30	0.22	0.75	15.1	171.	1.2	2.1	7.3	2.3
10. Zn 1st Cl. Tail.	5.28	0.16	0.64	4.99	146.	1.4	2.9	3.8	3.2
11. Zn Rougher Tail.	68.94	0.067	0.42	0.59	65.5	7.8	24.4	5.9	18.6
Head (Calculated)	100.00	0.59	1.18	6.87	242.2	100.0	100.0	100.0	100.0

Calculated Grades and Recoveries

Products 1 and 2	2.55	18.12	1.60	10.0	3032.	77.7	3.4	4.0	31.9
Products 1 to 3	2.73	16.97	2.07	10.2	3121.	77.9	4.7	4.1	35.2
Products 1 to 4	7.28	6.69	9.90	6.83	2062.	81.9	60.8	7.3	62.0
Products 3 and 4	4.73	0.53	14.38	4.74	1538.	4.2	57.4	3.3	30.1
Products 1 to 5	8.74	5.68	8.54	6.78	1794.	83.5	63.0	8.7	64.8
Products 1 to 6	12.08	4.21	6.49	6.96	1386.	85.4	66.2	12.3	69.2
Products 7 and 8	10.40	0.24	0.50	46.74	156.	4.2	4.4	70.7	6.7
Products 7 to 10	18.98	0.21	0.58	29.63	156.	6.8	9.4	81.8	12.2
Products 7 to 11	87.92	0.10	0.45	6.86	85.	14.6	33.8	87.7	30.8

LAKEFIELD RESEARCH OF CANADA LIMITED
Lakefield, Ontario
September 14, 1983

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